ClassIBS

ISTHMUS BUREAU OF SHIPPING

PART 6
FIRE PROTECTION, DETENTION AND EXTINCTION

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PRINCIPLES FOR THE CLASSIFICATION AND CONSTRUCTION OF STEEL SHIPS

PART 6 FIRE PROTECTION, DETECTION AND EXTINCTION

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Chapter 1 GENERAL

1.1 General

1.1.1 Application

1. Construction and arrangement for fire protection, detection and extinction are to be in accordance with those specified in this Part. To the construction and arrangement for fire protection, detection and extinction in ships which come under one of the following **(1)** to **(5)**, the provisions of **Chapter 21** may apply in place of the requirements of **Chapters 4** to **20**:

(1) Ships of less than 500 *gross tonnage*;

(2) Ships not provided with propulsion machinery;

(3) Ships solely engaged in fishing;

(4) Ships not engaged on international voyages; and

(5) Ships approved for limited service areas.

2. Notwithstanding **-1** above, the construction and arrangement for fire protection, detection and extinction for ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk are to be in accordance with the requirements in *IGC and IBC Codes IMO*, except where specially required in this Chapter.

3. The Society may require additional construction and arrangement for fire protection, detection and extinction corresponding to the purpose and construction of ships.

4. Unless expressly provided otherwise in this Part;

(1) Requirements not referring to a specific ship type are to apply to ships of all types; and

(2) Requirements referring to tankers are to apply to tankers in accordance with the requirements specified in **1.2.1**.

1.1.2 Equivalency

Alternative construction, equipment, arrangement and materials may be accepted by the Society, provided that the Society is satisfied with their equivalency to those required in this Part in accordance with the requirements of **Chapter 17**.

1.1.3 National Requirements

With respect to the construction and arrangement for fire protection, detection and extinction, attention is to be paid to compliance with the International Convention and the National Regulation of the country in which ships registered, in addition to the requirements in this Part. The Society may apply special requirements as instructed by the flag-government of ships or the government of sovereign nation in which ships navigate.

1.2 Application of Requirements for Tankers

1.2.1 Application to Tankers

Requirements for tankers in this Part are to apply to tankers carrying crude oil and petroleum products having a flashpoint not exceeding 60ºC (closed cup test), as determined by an approved flashpoint apparatus, and a Reid vapour pressure which is below the atmospheric pressure or other liquid products having a similar fire hazard.

1.2.2 Additional Requirements

1. Where liquid cargoes other than those referred to in **1.2.1** or liquefied gases which introduce additional fire hazards are intended to be carried, additional safety measures are to be required, having due regard to the provisions of *IGC and IBC Codes IMO*, as appropriate.

2. A liquid cargo with a flashpoint of less than 60ºC for which a regular foam fire-fighting system complying with the requirements of Chapter 34 is not effective, is to be considered to be a cargo introducing additional fire hazards in this context. The following additional measures are required:

(1) The foam are to be of alcohol resistant type;

(2) The type of foam concentrates for use in chemical tankers are to be to the satisfaction of the Society;

(3) the capacity and application rates of the foam extinguishing system are to comply with the requirements of *Chapter 11 of IBC Code IMO*, except that lower application rates may be accepted based on performance tests. For tankers fitted with inert gas systems, a quantity of foam concentrate is to be sufficient for 20 minutes of foam generation.

3. For the purpose of this paragraph, a liquid cargo with a vapour pressure greater than 0.1013 *MPa* (1.013 *bar*) absolute at 37.8ºC is to be considered to be a cargo introducing additional fire hazards. Ships carrying such substances are to comply with *IBC Code IMO*. When ships operate in restricted areas and at restricted times, the Society may agree to waive requirements for refrigeration systems in *IBC Code IMO*.

1.2.3 Liquid Cargoes with a Flashpoint above 60 ºC

1. Liquid cargoes with a flashpoint above 60 ºC other than oil products or liquid cargoes subject to the requirements of *IBC Code IMO* may be considered to constitute a low fire risk, not requiring the protection of a foam extinguishing system.

2. Tankers carrying petroleum products with a flashpoint above 60 ºC (closed cup test), as determined by an approved flashpoint apparatus, are to comply with the requirements provided in **10.2.1-4(4)** and **10.10.2-2** and the requirements for cargo ships other than tankers, except that, in lieu of the fixed fire extinguishing system required in **10.7**, they are to be fitted with a fixed deck foam system which is to comply with the provisions of **Chapter 34**.

1.2.4 Combination Carriers

Combination carriers are not to carry cargoes other than oil unless all cargo spaces are empty of oil and gas-freed.

1.3 Use of Toxic Substances

1.3.1 Use of Toxic Extinguishing Media

The use of a fire-extinguishing medium which either by itself or under expected conditions of use gives off toxic gases, liquids and other substances in such quantities as to endanger persons are not to be permitted.

Chapter 2 FIRE SAFETY OBJECTIVES AND FUNCTIONAL REQUIREMENTS

2.1 General

2.1.1 Fire Safety Objectives

The fire safety objectives of this Chapter are to:

(1) Prevent the occurrence of fire and explosion;
(2) reduce the risk to life caused by fire;
(3) reduce the risk of damage caused by fire to the ship, its cargo, and the environment;
(4) Contain, control and suppress fire and explosion in the compartment of origin; and
(5) Provide adequate and readily accessible means of escape for passengers and crew.

2.2 Requirements

2.2.1 Functional Requirements

In order to achieve the fire safety objectives in **2.1.1**, the following functional requirements are embodied in the regulations of this Part as appropriate:

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

(2) Separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;

(3) restricted use of combustible materials;

(4) Detection of any fire in the zone of origin;

(5) Containment and extinction of any fire in the space of origin;

(6) Protection of means of escape and access for fire-fighting;

(7) Ready availability of fire-extinguishing appliances; and

(8) Minimization of possibility of ignition of flammable cargo vapour.

2.3 Achievement

2.3.1 Achievement of Fire Safety Objectives

The fire safety objectives set out in **2.1.1** are to be achieved by ensuring compliance with the prescriptive requirements specified in Chapters 4 to 20 (except **Chapter 17**), or by alternative design and arrangements which comply with **Chapter 17**. A ship is to be considered to meet the functional requirements in **2.2.1** and to achieve the fire safety objectives set out in **2.1.1** when either:

(1) The ships design and arrangements, as a whole, comply with the relevant prescriptive requirements in **Chapters 4** to **20** (except **Chapter 17**);

(2) The ships design an d arrangements, as a whole, have been reviewed and approved in accordance with **Chapter 17**; or

(3) Part(s) of the ships designs and arrangements have been reviewed and approved in accordance with **Chapter 17** of this Part and the remaining parts of the ship comply with the relevant prescriptive requirements in **Chapters 4** to **20** (except **Chapter 17**).

Chapter 3 DEFINITIONS

3.1 General

3.1.1 General Rules

For the purpose of this Part, unless expressly provided otherwise, the following definitions are to apply.

3.2 Definitions

3.2.1 Accommodation Spaces

Accommodation spaces are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobby rooms, barber shops, pantries containing no cooking appliances and similar spaces.

3.2.2 "*A*" Class Divisions

"A" class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:

(1) They are to be constructed of steel or other equivalent material;

(2) They are to be suitably stiffened;

(3) They are to be insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180ºC above the original temperature, within the time listed below:

Class "*A* – 60"	60 minutes
Class "*A* – 30"	30 minutes
Class "*A* – 15"	15 minutes
Class "*A* – 0"	0 minute

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

(5) They are to be ensured by a test of a prototype bulkhead or deck in accordance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity and temperature rise, and to be approved by the Society or organizations deemed appropriate by the Society.

3.2.3 Atriums

Atriums are public spaces within a single main vertical zone spanning three or more open decks.

3.2.4 "*B*" Class Divisions

"*B*" class divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

(1) they are to be constructed of approved non-combustible materials and all materials used in the construction and erection of "*B"* class divisions are non-combustible, with the exception that combustible veneers may be permitted provided they meet other appropriate requirements of this chapter;

(2) They are to have an insulation value such that the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225 ºC above the original temperature, within the time listed below:

Class "*B* – 15"	15 minutes
Class "*B* – 0"	0 minute

(3) They are to be constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test; and

(4) They are to be ensured by a test of a prototype deck in accordance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity and temperature rise, and to be approved by the Society or organizations deemed appropriate by the Society.

3.2.5 Bulkhead Deck

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

3.2.6 Cargo Area

Cargo area is that part of the ship that contains cargo holds, cargo tanks, slop tanks and cargo pump-rooms including pump-rooms, cofferdams, ballast and void spaces adjacent to cargo tanks and also deck areas throughout the entire length and breadth of the part of the ship over the above-mentioned spaces.

3.2.7 Cargo Ship

Cargo ship is any ship which is not a passenger ship.

3.2.8 Cargo Spaces

Cargo spaces are spaces used for cargo, cargo oil tanks, tanks for other liquid cargo and trunks to such spaces.

3.2.9 Central Control Station

Central control station is a control station in which the following control and indicator functions are centralized:

(1) Fixed fire detection and fire alarm systems;

(2) Automatic sprinkler, fire detection and alarm systems;

(3) Fire door indicator panels;

(4) Fire door closure;

(5) Watertight door indicator panels;

(6) Watertight door closures;

(7) Ventilation fans;

(8) general/fire alarms;

(9) Communication systems including telephones; and

(10) Microphones to public address systems.

3.2.10 "C" Class Divisions

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

3.2.11 Chemical Tanker

Chemical tanker is a cargo ship constructed or adapted and used for the carriage in bulk of any liquid product of a flammable nature listed in **IBC Code**.

3.2.12 Closed Ro-Ro Spaces

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

3.2.13 Closed Vehicle Spaces

Closed vehicle spaces are vehicle spaces which are neither open vehicle spaces nor weather decks.

3.2.14 Combination Carrier

Combination carrier is a tanker designed to carry both oil and solid cargoes in bulk.

3.2.15 Combustible Material

Combustible material is any material other than a non-combustible material.

3.2.16 Continuous B Class Ceilings or Linings

Continuous "B" class ceilings or linings are those "*B"* class ceilings or linings which terminate at an "*A"* or "*B"* class division.

3.2.17 Continuously Manned Central Control Station

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

3.2.18 Control Stations

Control stations are those spaces in which the ships radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment is centralized. Spaces where the fire recording or fire control equipment is centralized are also considered to be *a fire control station.*

3.2.19 Crude Oil

Crude oil is any oil occurring naturally in the earth whether or not treated to render it suitable for transportation and includes crude oil where certain distillate fractions may have been removed from or added to.

3.2.20 Dangerous Goods

Dangerous goods are those goods referred to in the *IMDG Code*, as defined in *Chapter VII* of *SOLAS*), as amended.

3.2.21 Deadweight

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.

3.2.22 Fire Safety Systems Code

Fire Safety Systems Code (*FSS Code*) means the International Code for Fire Safety Systems as adopted by the Maritime Safety Committee (hereinafter referred to as "*MSC"* of the International Maritime Organization (hereinafter referred to as "*IMO"*) by resolution *MSC*.98(73), as may be amended by the *IMO*, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present *SOLAS* concerning the amendments procedures applicable to the annex other than chapter I thereof.

3.2.23 Fire Test Procedures Code

Fire Test Procedures Code (FTP Code) means the International Code for Application of Fire Test Procedures as adopted by the *MSC* of the *IMO* by resolution *MSC*.61 (67), as may be amended by the *IMO*, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present *SOLAS* concerning the amendments procedures applicable to the annex other than chapter I thereof.

3.2.24 Flashpoint

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

3.2.25 Gas Carrier

Gas carrier is a cargo ship constructed or adapted and used for the carriage in bulk of any liquefied gas or other products of a flammable nature listed in *IGC Code IMO*.

3.2.26 Helicopter Deck

Helicopter deck is a purpose-built helicopter landing area or winching area located on a ship including all structure, fire-fighting appliances and other equipment necessary for the safe operation of helicopters. Helicopter deck for helicopter landing is a helicopter landing deck and helicopter deck for winching is a helicopter winching deck.

3.2.27 Helicopter Facility

Helicopter facility is a helicopter deck including any refuelling and hangar facilities.

3.2.28 Lightweight

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

3.2.29 Low Flame Spread

Low flame spread means that the surface thus described will adequately restrict the spread of flame, this being approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code.

3.2.30 Machinery Spaces

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

3.2.31 Machinery Spaces of Category A

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

(1) Internal combustion machinery used for main propulsion;

(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, or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc.

3.2.32 Main Vertical Zones

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

3.2.33 Non-combustible Material

Non-combustible material is a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750ºC, this being approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code.

3.2.34 Oil Fuel Unit

Oil fuel unit is the following equipment. However, oil fuel transfer pumps are not considered as oil fuel units.

(1) Equipments used for the preparation of oil fuel for delivery to oil-fired boilers (including fired inert gas generators)

(2) Equipments used for the preparation for delivery of heated oil to internal combustion engines (including gas turbines)

(3) Equipments used for the preparation for delivery of oil to internal combustion engines (including gas turbines) at a pressure of more than 0.18 *MPa*

(4) Oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18 *MPa*.

3.2.35 Open Ro - Ro Spaces

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

3.2.36 Open Vehicle Spaces

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

3.2.37 Passenger Ship

Passenger ship is a ship which carries more than 12 passengers. For the purpose of this Part, a passenger means every person other than:

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

(2) A child under one year of age.

3.2.38 Prescriptive Requirements

Prescriptive requirements means the construction characteristics, limiting dimensions, or fire safety systems specified in **Chapters 4** to **20** (except **Chapter 17**).

3.2.39 Public Spaces

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

3.2.40 Rooms Containing Furniture and Furnishings of Restricted Fire Risk

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

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

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

(3) Draperies, curtains and other suspended textile materials have qualities of resistance to the propagation of flame not inferior to those of wool of mass 0.8 kg/m^2, this being approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code;

(4) Floor coverings have low flame spread characteristics;

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

(6) Upholstered furniture has qualities of resistance to the ignition and propagation of flame, this being approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code; and

(7) Bedding components have qualities of resistance to the ignition and propagation of flame, this being approved by the Society or organizations deemed appropriate by the Society determined in accordance with the Fire Test Procedures Code.

3.2.41 Ro-Ro spaces

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

3.2.42 Ro-Ro Passenger Ship

RO-ro passenger ship means a passenger ship with ro-ro spaces or special category spaces.

3.2.43 Steel or Other Equivalent Material

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

3.2.44 Sauna

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

3.2.45 Service Spaces

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

3.2.46 Special Category Spaces

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

3.2.47 Standard Fire Test

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

3.2.48 Tanker

Tanker is a cargo ship constructed or adapted for the carriage in bulk of liquid cargoes of a flammable nature except chemical tankers and gas carriers.

3.2.49 Vehicle Spaces

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

3.2.50 Weather Deck

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

3.2.51 Fire Damper

Fire damper is a device installed in a ventilation duct, which under normal conditions remains open allowing flow in the duct, and is closed during a fire, preventing the flow in the duct to resist the passage of fire. Fire dampers are classified as follows:

(1) *Automatic fire damper* is as fire damper that closes independently in response to exposure to fire products;

(2) *Manual fire damper* is a fire damper that is intended to be opened or closed by the crew by hand at the damper itself; and

(3) *Remotely operated fire damper* is a fire damper that is closed by the crew a control located at a distance away from the controlled damper.

3.2.52 Vehicle carrier

Vehicle carrier is a cargo ship with multi deck ro-ro spaces designed for the carriage of empty cars and trucks as cargo.

Chapter 4 PROBABILITY OF IGNITION

4.1 General

4.1.1 Purpose

The purpose of this Chapter is to prevent the ignition of combustible materials or flammable liquids. For this purpose, the following functional requirements are to be met:

(1) Means are to be provided to control leaks of flammable liquids;

(2) Means are to be provided to limit the accumulation of flammable vapours;

(3) The ignitability of combustible materials are to be restricted;

(4) Ignition sources are to be restricted;

(5) Ignition sources are to be separated from combustible materials and flammable liquids; and

(6) The atmosphere in cargo tanks is to be maintained out of the explosive range.

4.1.2 Other Requirements

With respect to the design and fabrication of pipes, valves and pipe fittings, the requirements of **Part 7** are to apply, in addition to the requirements in this Part.

4.2 Arrangements for Oil Fuel, Lubrication Oil and Other Flammable Oils

4.2.1 Limitations in the Use of Oils as Fuel

The following limitations are to apply to the use of oil as fuel:

(1) Except as otherwise permitted by this paragraph, no oil fuel with a flashpoint of less than 60ºC is to be used;

(2) In emergency generators oil fuel with a flashpoint of not less than 43ºC may be used;

(3) The use of oil fuel having a flashpoint of less than 60ºC but not less than 43ºC may be permitted (e.g., for feeding the emergency fire pump s engines and the auxiliary machines which are not located in the machinery spaces of category *A*) subject to the following:

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

   (b) Provisions for the measurement of oil temperature are to be provided on the suction pipe of the oil fuel pump;

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

   (d) Pipe joints of welded construction or of circular cone type or spherical type union joint are to be applied as much as possible; and

   (e) Other requirements when deemed appropriate by the Society,

(4) The use of fuel having a lower flashpoint than otherwise specified in this paragraph, for example crude oil, may be permitted provided that such fuel is not stored in any machinery space and subject to the approval by the Society of the complete installation.

(5) Fuel oil is not to be heated to the temperature within 10ºC below the flash point of the fuel oil in the oil tanks, unless considered appropriate by the Society.

4.2.2 Arrangements for Oil Fuel

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

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

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

(3) Fuel oil tanks are to comply with the following requirements:

(a) Fuel oil, lubrication oil and other flammable oils are to not be carried in forepeak tanks.

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

(c) No oil fuel tank is to be situated where spillage or leakage therefrom can constitute a fire or explosion hazard by falling on heated surfaces. Valves, cocks and other fittings fitted on fuel oil tanks are to be located in safe positions so as to be protected from external damage. The distance between tanks of flammable oil and high temperature positions of machinery installations is to be enough to prevent the oil from being heated more than the flash point of the oil.

(d) Oil fuel pipes, which, if damaged, would allow oil to escape from a storage, settling or daily service tank having a capacity of 500 l and above situated above the double bottom, are to be fitted with a cock or valve directly on the tank capable of being closed from a safe position outside the space concerned in the event of a fire occurring in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel or similar space, valves on the tank are to be fitted but control in the

event of fire may be effected by means of an additional valve on the pipe or pipes outside the tunnel or similar space. If such an additional valve is fitted in the machinery space it is to be operated from a position outside this space. The controls for remote operation of the valve for the emergency generator fuel tank are to be in a separate location from the controls for remote operation of other valves for tanks located in machinery spaces.

(e) Safe and efficient means of ascertaining the amount of oil fuel contained in any oil fuel tank are to be provided.

i) Where sounding pipes are used, they are not to terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they are not to terminate in passenger or crew spaces. As a general rule, they are not to terminate in machinery spaces. However, where the Society considers that these latter requirements are impracticable, it may permit termination of sounding pipes in machinery spaces on condition that all the following requirements are met:

1) An oil-level gauge is provided meeting the requirements of **ii**) below;

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

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

ii) Oil-level gauges used in place of sounding pipes are to comply with the following requirements. In addition, gauges are to be of the approved ones by the Society or to comply with the standard deemed approved by the Society.

1) The gauges are to be maintained in the proper condition to ensure their continued accurate functioning in service.

2) The failure of the gauges or overfilling of the tank are not to permit release of fuel into the space.

3) The glasses used for the gauges are to be of heat resistant quality, and adequately protected from mechanical damage. However, the use of cylindrical gauge glasses is prohibited.

4) The self-closing valves are to be provided between the gauges and tanks where flat glass level glasses or other gauges deemed necessary by the Society are used.

(4) Provision are to be made to prevent overpressure in any oil tank or in any part of the oil fuel system, including the filling pipes served by pumps on board. Air and overflow pipes and relief valves are to discharge to a position where there is no risk of fire or explosion from the emergence of oils and vapour and are not to lead into crew spaces, passenger spaces or into closed ro-ro spaces, machinery spaces or similar spaces. Where a level switch is provided, its penetration part is to be protected from a fire by means of a steel enclosure or other enclosures.

(5) Oil fuel piping is to comply with the following requirements:

(a) Oil fuel pipes and their valves and fittings are to be of steel or other approved material, except that restricted use of flexible hoses is permissible in positions where the Society is satisfied that they are necessary. Such flexible hoses and end fittings are to comply with **12.1.6** and **12.3.4** of **Part 7**. Use of ordinary cast iron valves in piping systems is to comply with the requirements of **12.1.5** of **Part 7**.

(b) External high-pressure fuel delivery lines between the high-pressure fuel pumps and fuel injectors are to be protected with a jacketed piping system capable of containing fuel from a high-pressure line failure. A jacketed pipe incorporates an outer pipe into which the high-pressure fuel pipe is placed, forming a permanent assembly. The jacketed piping system is to include a means for collection of leakages and arrangements are to be provided for an alarm to be given of a fuel line failure. However, when these pipes are deemed by the Society, to have appropriate designs, constructions and arrangements for minimizing the fire risk, the requirements may not apply.

(c) Oil fuel lines are not to be located immediately above or near units of high temperature including boilers, steam pipelines, exhaust manifolds, silencers or other equipment required to be insulated by (6). As far as practicable, oil fuel lines are to be arranged far apart from hot surfaces, electrical installations or other sources of ignition and are to be screened or otherwise suitably protected to avoid oil spray or oil leakage on to the sources of ignition. The number of joints in such piping systems is to be kept to a minimum.

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

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

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

(6) Protection of high temperature surfaces is to be in accordance with the followings:

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

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

(7) Sight-flow glasses where used in the oil fuel system are to be approved to have a suitable degree of fire resistance.

(8) The means specified in **(a)** and **(b)** below are to be taken to each space where pre-treatment equipment for flammable liquid such as purifiers, oil heaters, etc. is installed. However, the requirements may be dispensed

with where as deemed appropriate by the Society, taking into account of the construction of ships for fire protection, or the arrangement of the above equipment and the countermeasures of ships taken against oil leakage and firing;

(a) Each space in which the main components in the above equipment are installed is to be separated from other machinery installations, enclosed by steel bulkheads extending from deck to deck with self-closing steel doors.

(b) Those specified in **i)** to **iv)** below are to be provided for each of the enclosed rooms in **(a)** above;

i) A fixed fire detection and fire alarm system in accordance with the requirements of 7.2

ii) A fixed fire-extinguishing system deemed as appropriate by the Society, capable of being activated from outside the room

iii) Independent mechanical ventilation or a ventilation arrangement which can be isolated from the mechanical ventilation

iv) A closing arrangement of the above ventilation openings from a position close to where the above fixed fire-extinguishing system is activated.

4.2.3 Arrangements for Lubricating Oil

The arrangements for the storage, distribution and utilization of oil used in pressure lubrication systems are to be such as to ensure the safety of the ship and persons on board. The arrangements made in machinery spaces of category A, and whenever practicable in other machinery spaces, are at least to comply with the provisions of **(1), (2), (3)(c), (3)(d), (3)(e), (4), (5)(a), (5)(c), (6)** and **(7)** of 4.2.2 except that:

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

(2) sounding pipes may be approved in machinery spaces; however, the requirements of **1)** and **3)** of 4.2.2(3)(e)i) need not be applied on condition that the sounding pipes are fitted with appropriate means of closure;

(3) the provisions of 4.2.2(3)(d) are also to apply to lubricating oil tanks except those having a capacity less than 500 *l*, storage tanks on which valves are closed during the normal operation mode of the ship, or where it is determined that an unintended operation of a quick closing valve on the oil lubricating tank would endanger the safe operation of the main propulsion and essential auxiliary machinery.

4.2.4 Arrangements for Other Flammable Oils

1. The arrangements for the storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heating systems are to be such as to ensure the safety of the ship and persons on board. In locations where means of ignition are present, such arrangements are at least to comply with the provisions of **(1), (2), (3)(c), (3)(e), (5)(c)** and **(6)** of 4.2.2 and with the provisions of (4) and (5)**(a)** of 4.2.2 in respect of strength and construction. With respect to thermal oil systems, such arrangements are to comply with the provisions of 4.2.2**(3)(d)** in addition to the above. Suitable oil collecting arrangements for

leaks are to be fitted below hydraulic valves and cylinders except those having no danger of fire caused by the spillage.

2. Hydraulic units with working pressure above 1.5 *MPa* are preferably to be placed in separate spaces. If it is impracticable to locate such units in a separate space, adequate shielding is to be provided.

4.2.5 Arrangements for Oil Fuel in Periodically Unattended Machinery Spaces

In addition to the requirements of 4.2.1 to 4.2.4, the oil fuel and lubricating oil systems in a periodically unattended machinery space are to comply with the following:

(1) Where daily service oil fuel tanks are filled automatically, or by remote control, means are to be provided to prevent overflow spillages. Other equipment which treats flammable liquids automatically (e.g. oil fuel purifiers) which, whenever practicable, is to be installed in a special space reserved for purifiers and their heaters, is to have arrangements to prevent overflow spillages; and

(2) Where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high temperature alarm is to be provided if the flashpoint of the oil fuel can be exceeded.

4.3 Arrangements for Gases for Domestic Purpose

4.3.1 Arrangements for Gaseous Fuel for Domestic Purpose

Gaseous fuel systems used for domestic purposes are to be of suitable type to the satisfaction of the Society. Storage of gas bottles is to be located on the open deck or in a well-ventilated space which opens only to the open deck.

4.3.2 Arrangements for Gas Welding Equipment

Gas welding equipment are to be of suitable type to the satisfaction of the Society. Storage of gas bottles is to be located on the open deck or in a well-ventilated space which opens only to the open deck.

4.4 Miscellaneous Items of Ignition Sources and Ignitability

4.4.1 Electric Radiators

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

4.4.2 Waste Receptacles

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

4.4.3 Insulation Surfaces Protected against Oil Penetration

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

4.4.4 Primary Deck Coverings

Primary deck coverings, if applied within accommodation and service spaces and control stations, are to be of approved material by the Society or organizations deemed appropriate by the Society, which will not readily ignite, this being determined in accordance with the Fire Test Procedures Code.

4.5 Cargo Areas of Tankers

4.5.1 Separation of Cargo Tanks

1. Cargo pump-rooms, cargo tanks, slop tanks and cofferdams are to be positioned forward of machinery spaces. However, oil fuel banker tanks need not be forward of machinery spaces. Cargo tanks and slop tanks are to be isolated from machinery spaces by cofferdams, cargo pump-rooms, oil bunker tanks or ballast tanks. Pump-rooms containing pumps and their accessories for ballasting those spaces situated adjacent to cargo tanks and slop tanks and pumps for oil fuel transfer, are to be considered as equivalent to a cargo pump-room within the context of this paragraph provided that such pump-rooms have the same safety standard as that required for cargo pump-rooms. Pump-rooms intended solely for ballast or oil fuel transfer, however, need not comply with the requirements of **10.9.** The lower portion of the pump-room may be recessed into machinery spaces of category A to accommodate pumps, provided that the deck head of the recess is in general not more than one third of the moulded depth above the keel, except that in the case of ships of not more than 25,000 *tonnes deadweight*, where it can be demonstrated that for reasons of access and satisfactory piping arrangements this is impracticable, the Society may permit a recess in excess of such height, but not exceeding one half of the moulded depth above the keel.

2. Main cargo control stations, control stations, accommodation and service spaces (excluding isolated cargo handling gear lockers) are to be positioned aft of all cargo tanks, slop tanks, and spaces which isolate cargo or slop tanks from machinery spaces, but not necessarily aft of the oil fuel bunker tanks and ballast tanks, and are to be arranged in such a way that a single failure of a deck or bulkhead are not to permit the entry of gas or fumes from the cargo tanks into an accommodation space, main cargo control stations, control stations, or service spaces. A recess provided in accordance with **-1** above need not be taken into account when the position of these spaces is being determined.

3. However, where deemed necessary, the Society may permit main cargo control stations, control stations, accommodation and service spaces forward of the cargo tanks, slop tanks and spaces which isolate cargo and slop tanks from machinery spaces, but not necessarily forward of oil fuel bunker tanks or ballast tanks. Machinery spaces, other than those of category *A*, may be permitted forward of the cargo tanks and slop tanks provided they are isolated from the cargo tanks and slop tanks by cofferdams, cargo pump - rooms, oil fuel bunker tanks or ballast tanks, and have at least one portable fire extinguisher. In case where they contain internal combustion machinery, one approved foam - type extinguisher of at least 45 *l* capacity or equivalent is to be arranged in addition to portable fire extinguishers. If operation of a semi - portable fire extinguisher is impracticable, this fire extinguisher may be replaced by two additional portable fire extinguishers. Accommodation spaces, main cargo control spaces, control stations and service spaces are to be arranged in such a way that a single failure of a deck or bulkhead is not to permit the entry of gas or fumes from the cargo tanks into such spaces. In addition, where deemed necessary for the safety or navigation of the ship, the Society may permit machinery spaces containing internal combustion machinery not being main propulsion machinery having an output greater than 375 *kW* to be located forward of the cargo area provided the arrangements are in accordance with the provisions of this paragraph.

4. In combination carriers only:

(1) The slop tanks are to be surrounded by cofferdams except where the boundaries of the slop tanks, where slop may be carried on dry cargo voyages, are part of the hull, main cargo deck, cargo pump-room bulkhead or oil fuel bunker tank. These cofferdams are not to be open to a double bottom, pipe tunnel, pump-room or other enclosed space, are not to be used for cargo or ballast and are not to be connected to piping systems serving oil cargo or ballast. Means are to be provided for filling the cofferdams with water and for draining them. Where the boundary of a slop tank is part of the cargo pump-room bulkhead, the pump-room is not to be open to the double bottom, pipe tunnel or other enclosed space ; however, openings provided with gas-tight bolted covers may be permitted;

(2) Means are to be provided for isolating the piping connecting the pump-room with the slop tanks referred to in **(1)** Above. The means of isolation are to consist of a valve followed by a spectacle flange or a spool piece with appropriate blank flanges. This arrangement is to be located adjacent to the slop tanks, but where this is unreasonable or impracticable; it may be located within the pump-room directly after the piping penetrates the bulkhead. A separate permanently installed pumping and piping arrangement incorporating a manifold, provided with a shut-off valve and a blank flange, is to be provided for discharging the contents of the slop tanks directly to the open deck for disposal to shore reception facilities when the ship is in the dry cargo mode. When the transfer system is used for slop transfer in the dry cargo mode, it is to have no connection to other systems. Separation from other systems by means of removal of spool pieces may be accepted;

(3) Hatches and tank cleaning openings to slop tanks are only to be permitted on the open deck and are to be fitted with closing arrangements. Except where they consist of bolted plates with bolts at watertight spacing, these closing arrangements are to be provided with locking arrangements under the control of the responsible ships officer; and

(4) Where cargo wing tanks are provided, cargo oil lines below deck are to be installed inside these tanks. However, the Society may permit cargo oil lines to be placed in special ducts provided there are capable of

being adequately cleaned and ventilated to the satisfaction of the Society. Where cargo wing tanks are not provided, cargo oil lines below deck are to be placed in special ducts.

5. Where the fitting of a navigation position above the cargo area is shown to be necessary, it is to be for navigation purposes only and it is to be separated from the cargo tank deck by means of an open space with a height of at least 2*m*. The fire protection requirements for such a navigation position are to be that required for control stations, as specified in **9.2.4** and other provisions in **Chapters 4**, **5** and **6** for tankers, as applicable.

6. Means are to be provided to keep deck spills away from the accommodation and service areas. This may be accomplished by provision of a permanent continuous coaming of a height of at least 300 *mm*, extending from side to side. Special consideration is to be given to the arrangements associated with stern loading.

7. For the protection of cargo tanks carrying crude oil and petroleum products having a flashpoint not exceed 60°C, materials readily rendered ineffective by heat and spread fire to the cargo are not to be used for the valves, fittings, tank opening covers, cargo vent pipings and cargo pipings.

4.5.2 Restriction on Boundary Openings

1. Except as permitted in **-2** below, access doors, air inlets and openings to accommodation spaces, service spaces, control stations and machinery spaces are not to face the cargo area. They are to be located on the transverse bulkhead not facing the cargo area or on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship but not less than 3 *m* from the end of the superstructure or deckhouse facing the cargo area. This distance need not exceed 5 *m*.

2. The Society may permit access doors in boundary bulkheads facing the cargo area or within the 5 *m* limits specified in **-1** above, to main cargo control stations and to such service spaces as provision rooms, store-rooms and lockers, provided they do not give access directly or indirectly to any other space containing or provided for accommodation, control stations or service spaces such as galleys, pantries or workshops, or similar spaces containing sources of vapour ignition. The boundary of such a space is to be insulated to "*A-60"* standard, with the exception of the boundary facing the cargo area. Bolted plates for the removal of machinery may be fitted within the limits specified in **-1** above. Wheelhouse doors and wheelhouse windows may be located within the limits specified in **-1** above so long as they are designed to ensure that the wheelhouse can be made rapidly and efficiently gas and vapour tight.

3. Windows and sidescuttles facing the cargo area and on the sides of the superstructures and deckhouses within the limits specified in **-1** above are to be of the fixed (non-opening) type. Such windows and sidescuttles, except wheelhouse windows, are to be constructed to "*A-60"* class standard, except that "*A-0*" class standard is acceptable for windows and sidescuttles outside the area insulated to "*A-60"* class standard as required in **9.2.4-3.**

4. Where there is pipe tunnel in cargo area, the pipe tunnel is not to be open to engine rooms and is to be provided with at least two exits to open deck arranged at a maximum distance from each other. However, one of these exits may lead to the main pump room. Where there is permanent access from the pipe tunnel to the main pump-room, a watertight door is to be fitted complying with the requirements of **12.3** of **Part 2** and, in addition, with the following. For the application of **12.3** of **Part 2,** such doors are considered as those which are used at sea.

(1) In addition to the bridge operation, the watertight door is to be capable of being manually closed from outside the main pump-room entrance; and

(2) The watertight door is to be kept closed during normal operations of the ship except when access to the pipe tunnel is required.

5. Permanent approved gas tight lighting enclosures for illuminating cargo pump-rooms may be permitted in bulkheads and decks separating cargo pump-rooms and other spaces provided they are of adequate strength and the fire integrity and gas-tightness of the bulkhead or deck are maintained.

6. The arrangement of ventilation inlets and outlets and other deckhouse and superstructure boundary space openings is to be such as to complement the provisions of **4.5.3** and **11.6.** Such vents, especially for machinery spaces, are to be situated as far aft as practicable. Due consideration in this regard is to be given when the ship is equipped to load or discharge at the stern. Sources of ignition such as electrical equipment are to be so arranged as to avoid an explosion hazard.

4.5.3 Cargo Tank Venting

1. The venting systems of cargo tanks (including slop tanks) are to be entirely distinct from the air pipes of the other compartments of the ship. The arrangements and position of openings in the cargo tank deck from which emission of flammable vapours can occur are to be such as to minimize the possibility of flammable vapours being admitted to enclosed spaces containing a source of ignition, or collecting in the vicinity of deck machinery and equipment which may constitute an ignition hazard. In accordance with this general principle, the criteria in **-2** to **-5** below and **11.6** will apply.

2. Venting arrangements

(1) The venting arrangements in each cargo tank may be independent or combined with other cargo tanks and may be incorporated into the inert gas piping.

(2) Where the arrangements are combined with other cargo tanks, either stop valves or other acceptable means are to be provided to isolate each cargo tank. Where stop valves are fitted, they are to be provided with locking arrangements which are to be under the control of the responsible ship's officer. There is to be a clear visual indication of the operational status of the valves or other acceptable means. Where tanks have been isolated, it is to be ensured that relevant isolating valves are opened before cargo loading or ballasting or discharging of those tanks is commenced. Any isolation must continue to permit the flow caused by thermal variations in a cargo tank in accordance with **11.6.1(1).**

(3) If cargo loading and ballasting or discharging of a cargo tank or cargo tank group is intended, which is isolated from a common venting system, that cargo tank or cargo tank group is to be fitted with a means for over-pressure or under-pressure protection as required in **11.6.3-2**.

(4) The venting arrangements are to be connected to the top of each cargo tank and are to be self - draining to the cargo tanks under all normal conditions of trim and list of the ship. Where it may not be possible to provide self-draining lines, permanent arrangements are to be provided to drain the vent lines to a cargo tank.

3. The venting system is to be provided with devices to prevent the passage of flame into the cargo tanks. The design, testing and locating of these devices is to be of a type approved by the Society in accordance with the procedure deemed appropriate by the Society. Ullage openings are not to be used for pressure equalization. They are to be provided with self-closing and tightly sealing covers. Flame arresters and flame screens are not permitted in these openings.

4. Vent outlets for cargo handling and ballasting

(1) Vent outlets for cargo loading, discharging and ballasting required by **11.6.1(2)** are to:

(a) permit the free flow of vapour mixtures or the throttling of the discharge of the vapour mixtures to achieve a velocity of not less than 30 *m/s*;

(b) be so arranged that the vapour mixture is discharged vertically upwards;

(c) where the method is by free flow of vapour mixtures, be such that the outlet is to be not less than 6 *m* above the cargo tank deck or fore and aft gangway if situated within 4 *m* of the gangway and located not less than 10 *m* measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute ignition hazards; and

(d) where the method is by high-velocity discharge, be located at a height not less than 2 *m* above the cargo tank deck and not less than 10 *m* measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard. These outlets are to be provided with high velocity devices of an approved type.

(2) The arrangements for the venting of all vapours displaced from the cargo tanks during loading and ballasting are to comply with **4.5.3** and **11.6** and are to consist of either one or more mast risers, or a number of high-velocity vents. The inert gas supply main may be used for such venting.

5. In combination carriers, the arrangement to isolating slop tanks containing oil or oil residues from other cargo tanks is to consist of blank flanges which will remain in position at all times when cargoes other than liquid cargoes referred to in **1.2.1** are carried.

4.5.4 Ventilation

1. Ventilation systems in cargo pump rooms

(1) Cargo pump-rooms are to be mechanically ventilated and discharges from the exhaust fans are to be led to a safe place on the open deck. The ventilation of these rooms is to have sufficient capacity to minimize the possibility of accumulation of flammable vapours. The number of air changes is to be at least 20 *per hour*, based upon the gross volume of the space. The air ducts are to be arranged so that all of the space is effectively ventilated. The ventilation is to be of the suction type using fans of the non-sparking type. The outlets of exhaust ducts are to be led to atmosphere and to be fitted with wire mesh screens with mesh of suitable size. Where ventilation systems are driven by shafts passing through a pump room bulkhead or deck, gastight stuffing boxes of a type approved by the Society are to be fitted to shafts at the position of passing.

(2) Effective venting systems are to be provided to cofferdams adjacent to a cargo oil tank. Where air pipes are provided for this purpose, each air pipe is to be provided with an easily renewable wire gauze to prevent the passage of flame at their outlets, and they are not to be less than 50 *mm* in internal diameter. Where ventilation system is provided, the construction of the ventilation fan and the wire mesh screens fitted on the exhaust ducts are to comply with the requirements in (1) above. Air holes are to be cut in every part of the structure where there might be a change of gases being pocketed.

2. In combination carriers, all cargo spaces and any enclosed spaces adjacent to cargo spaces are to be capable of being mechanically ventilated. The mechanical ventilation may be provided by portable fans. An approved fixed gas warning system capable of monitoring flammable vapours is to be provided in cargo pump-rooms and pipe ducts and cofferdams, as referred to in **4.5.1-4**, adjacent to slop tanks. Suitable arrangements are to be made to facilitate measurement of flammable vapours in all other spaces within the cargo area. Such measurements are to be made possible from the open deck or easily accessible positions.

4.5.5 Inert Gas Systems

1. For tankers of *8,000 tonnes deadweight* and upwards, the protection of the cargo tanks (including slop tanks) is to be achieved by a fixed inert gas system in accordance with the requirements of **Chapter 35**, except that. The society may accept other equivalent systems or arrangements, as described in **6**.

2. Tankers operating with a cargo tank cleaning procedure using crude oil washing are to be fitted with an inert gas system complying with the requirements of **Chapter 35** and with fixed tank washing machines.

3. Tankers required to be fitted with inert gas systems are to comply with the following provisions:

(1) Double hull spaces are to be fitted with suitable connections for the supply of inert gas;

(2) Where hull spaces are connected to a permanently fitted inert gas distribution system, means are to be provided to prevent hydrocarbon gases from the cargo tanks entering the double hull spaces through the system; and

(3) Where such spaces are not permanently connected to an inert gas distribution system, appropriate means are to be provided to allow connection to the inert gas main.

4. The requirements for inert gas systems of **Chapter 35** need not be applied to all gas carriers:

(1) When carrying cargoes described in regulation 1.2.1, provided that they comply with the requirements for inert gas systems on chemical tankers established by the Society, based on the guidelines deemed appropriate by the Society; or

(2) When carrying flammable cargoes other than crude oil or petroleum products such as cargoes listed in *IBC Code IMO* provided that the capacity of tanks used for their carriage does not exceed 3,000 m^3 and the individual nozzle capacities of tank washing machines do not exceed 17.5 m^3/h and the total combined throughput from the number of machines in use in a cargo tank at any one time does not exceed 110 m^3/h.

5. The inert gas systems are to comply with the followings:

(1) The inert gas system is to be capable of inerting, purging and gas-freeing empty tanks and maintaining the atmosphere in cargo tanks with the required oxygen content

(2) Tankers fitted with a fixed inert gas system are to be provided with a closed ullage system.

6. The Society may, after having given consideration to the ship arrangement and equipment, accept other fixed installation.

7. For tanker of 8.000 tonnes deadweight and upwards but less than 20,000 tonnes deadweight, in lieu of fixed installations as required by -**6** above, the society may accept other equivalent arrangements or means of protection.

8. Equivalent systems or arrangements are to:

(1) Be capable of preventing dangerous accumulations of explosive mixtures in intact cargo tanks during normal service throughout the ballast voyage and necessary in-tank operations; and

(2) Be so designed as to minimize the risk of ignition from the generation of static electricity by the system itself.

9. Insert gas systems, which are installed in ships that -1 or -2 above does not apply to, are to be the satisfaction of the society.

4.5.6 Inerting, Purging and Gas-freeing

1. Arrangements for purging and/or gas-freeing are to be such as to minimize the hazards due to dispersal of flammable vapours in the atmosphere and to flammable mixtures in a cargo tank (including slop tanks).

2. The procedure for cargo tank purging and/or gas-freeing is to be carried out in accordance with **16.3.2.**

3. The arrangements for inerting, purging or gas-freeing of empty tanks as required in **4.5.5-5(1)** are to be to the satisfaction of the Society and to be such that the accumulation of hydrocarbon vapours in pockets formed by the internal structural members in a tank is minimized and that:

(1) On individual cargo tanks, the gas outlet pipe, if fitted, is to be positioned as far as practicable from the inert gas/air inlet and in accordance with **4.5.3** and **11.6**. The inlet of such outlet pipes may be located either at deck level or at not more than 1 m above the bottom of the tank;

(2) The cross-sectional area of such gas outlet pipe referred to in **(1)** above is to be such that an exit velocity of at least 20 *m/s* can be maintained when any three tanks are being simultaneously supplied with inert gas. Their outlets are to extend not less than 2 *m* above deck level; and

(3) Each gas outlet referred to in **(2)** above is to be fitted with suitable blanking arrangements.

4.5.7 Gas Measurement

The following measures are to be provided for gas measurement:

(1) Tankers are to be equipped with at less one portable instruments for measuring flammable vapour concentrations and at less one portable instruments for measuring oxygen concentrations, together with a sufficient set of spare. These measuring instruments are to be deemed appropriate by the Society.

(2) Arrangements of gas measurement in double hull and double bottom spaces, deemed appropriate by the Society, are to comply with the following requirements in **(a)** through **(c).**

(a) Suitable portable instruments for measuring oxygen and flammable vapour concentrations are to be provided. In selecting these instruments, due attention is to be given to their use in combination with the fixed gas - sampling - line systems referred to in **(b)** below.

(b) Where the atmosphere in double hull spaces cannot be reliably measured using flexible gas sampling hoses, such spaces are to be fitted with permanent gas sampling lines. The configuration of gas sampling lines is to be adapted to the design of such spaces.

(c) The materials of construction and the dimensions of gas sampling lines are to be such as to prevent restriction. Where plastic materials are used, they are to be electrically conductive.

(3) Arrangements for fixed hydrocarbon gas detection systems in double-hull and double-bottom spaces of oil tankers

(a) Oil tankers of 20,000 *tonnes* deadweight and above are to be provided with a fixed hydrocarbon gas detection system complying with the **Chapter 36** for measuring hydrocarbon gas concentrations in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks.

(b) Oil tankers provided with constant operative inverting systems for such spaces need not be equipped withfixed hydrocarbon gas detection equipment.

(c) Notwithstanding the above, cargo pump-rooms subject to the provisions of **4.5.10** need not comply with the requirements of this paragraph.

4.5.8 Air Supply to Double Hull and Double Bottom Spaces

1. Double hull and double bottom spaces are to be fitted with suitable connections for the supply of air.

2. Suitable numbers and sizes of fixed ventilation ducts or pipes are to be arranged in double hull and double bottom spaces for efficient venting as deemed necessary by the Society. Configuration of such ducts or pipes is to be suitable to the design of such spaces.

4.5.9 Protection of Cargo Area

Drip pans for collecting cargo residues in cargo lines and hoses are to be provided in the area of pipe and hose connections under the manifold area. Cargo hoses and tank washing hoses are to have electrical continuity over their entire lengths including couplings and flanges (except shore connections) and are to be earthed for removal of electrostatic charges.

4.5.10 Protection of Cargo Pump-rooms

In tankers:

(1) For cargo pumps, ballast pumps and stripping pumps installed in cargo pump rooms and driven by shafts passing through pump-room bulkheads, gas-tight stuffing boxes approved by the Society are to be fitted to the shafts at the bulkheads and flexible couplings are to be provided between the shafts and the pumps. The stuffing boxes are to be efficiently lubricated from outside the pump-room. The seal parts of stuffing boxes are to be of material that will not initiate sparks. These pumps are to be fitted with temperature sensing devices for bulkhead shaft glands, bearings and pump casings. A continuous audible and visual alarm signal is to be automatically effected in the cargo control room or the pump control station;

(2) Lighting in cargo pump-rooms, except emergency lighting, is to be interlocked with ventilation such that the ventilation is to be in operation when switching on the lighting. Failure of the ventilation system is not to cause the lighting to go out;

(3) A system, as deemed appropriate by the Society, for continuous monitoring of the concentration of hydrocarbon gases is to be fitted. Sampling points or detector heads are to be located in suitable positions in order that potentially dangerous leakages are readily detected. When the hydrocarbon gas concentration reaches a pre-set level which is not to be higher than 10% of the lower flammable limit (LFL), a continuous audible and visual alarm signal is to be automatically effected in the pump-room, engine control room, cargo control room and navigation bridge to alert personnel to the potential hazard; and

(4) All pump-rooms are to be provided with bilge level monitoring devices together with appropriately located alarms.

Chapter 5 FIRE GROWTH POTENTIAL

5.1 General

5.1.1 Purpose

The purpose of this Chapter is to limit the fire growth potential in every space of the ship. For this purpose, the following functional requirements are to be met:

(1) Means of control for the air supply to the space are to be provided;

(2) Means of control for flammable liquids in the space are to be provided; and

(3) The use of combustible materials is to be restricted.

5.2 Control of Air Supply and Flammable Liquid to the Space

5.2.1 Closing Appliances and Stopping Devices of Ventilation

1. The main inlets and outlets of all ventilation systems are to be capable of being closed from outside the spaces being ventilated. The means of closing are to be easily accessible as well as prominently and permanently marked and are to indicate whether the shutoff is open or closed.

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

5.2.2 Means of Control in Machinery Spaces

1. Means of control are to be provided for opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation, and closure of ventilator dampers.

2. Means of control are to be provided for stopping ventilating fans. Controls provided for the power ventilation serving machinery spaces are to be grouped so as to be operable from two positions, one of which is to be outside such spaces, where they will not be cut off in the event of fire in the space they serve. The means provided for stopping the power ventilation of the machinery spaces are to be entirely separated from the means provided for stopping ventilation of other spaces.

3. Means of control are to be provided for stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service pumps, thermal oil circulating pumps, cargo pumps and oil separators (purifiers). Such controls are to be located outside the space concerned, where they will not be cut off in the event of fire in the space they serve, in addition to inside such space. However, this requirement need not apply to oily water separators.

4. The controls required in -1 above and in **4.2.2(3) (d)** are to be located outside the space concerned, where they will not be cut off in the event of fire in the space they serve.

5.2.3 Additional Requirements for Means of Control in Periodically Unattended Machinery Spaces

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

5.3 Fire Protection Materials

5.3.1 Use of Non-combustible Materials

1. Insulating materials are to be non-combustible, except in cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces. Vapour barriers and adhesives used in conjunction with insulation, as well as the insulation of pipe fittings for cold service systems, need not be of non-combustible materials, but they are to be kept to the minimum quantity practicable and their exposed surfaces are to have low flame spread characteristics.

2. All linings, ceilings, draught stops and their associated grounds are to be of non-combustible materials in the following spaces:

(1) in accommodation and service spaces and control stations for ships where Method IC is specified as referred to in **9.2.2**; and

(2) In corridors and stairway enclosures serving accommodation and service spaces and control stations for ships where Method IIC or IIIC are specified as referred to in **9.2.2.**

5.3.2 Use of Combustible Materials

1. Non-combustible bulkheads, ceilings and linings fitted in accommodation and service spaces may be faced with combustible materials, facings, mouldings, decorations and veneers provided such spaces are bounded by non-combustible bulkheads, ceilings and linings in accordance with the provisions of **-2** to **-4** below and **Chapter 6**.

2. Combustible materials used on the surfaces and linings specified in **-1** above are to have a calorific value not exceeding 45 MJ/m^2 of the area for the thickness used. The requirements of this paragraph are not applicable to the surfaces of furniture fixed to linings or bulkheads.

3. Where combustible materials are used in accordance with **-1** above, they are to comply with the following Requirements:

(1) The total volume of combustible facings, mouldings, decorations and veneers in any accommodation and service spaces is not to exceed a volume equivalent to 2.5 *mm* veneer on the combined area of the walls and

ceiling linings. Furniture fixed to linings, bulkheads or decks need not be included in the calculation of the total volume of combustible materials; and

(2) In the case of ships fitted with an automatic sprinkler system complying with the provisions of **Chapter 28**, the above volume may include some combustible material used for erection of C class divisions.

4. The following surfaces are to have low flame spread characteristics:

(1) Exposed surfaces in corridors and stairway enclosures and of ceilings in accommodation and service spaces (except saunas) and control stations; and

(2) Surfaces and grounds in concealed or inaccessible spaces in accommodation and service spaces and control stations.

Chapter 6 SMOKE GENERATION POTENTIAL AND TOXICITY

6.1 General

6.1.1 Purpose

The purpose of this Chapter is to reduce the hazard to life from smoke and toxic products generated during a fire in spaces where persons normally work or live. For this purpose, the quantity of smoke and toxic products released from combustible materials, including surface finishes, during fire is to be limited.

6.2 Finishes

6.2.1 Paints, Varnishes and Other Finishes

Paints, varnishes and other finishes used on exposed interior surfaces are not to be capable of producing excessive quantities of smoke and toxic products; this being approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code.

6.3 Primary Deck Coverings

6.3.1 Primary Deck Coverings

Primary deck coverings, if applied within accommodation and service spaces and control stations, are to be of approved material which will not give rise to smoke or toxic or explosive hazards at elevated temperatures; this being approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code.

Chapter 7 DETECTION AND ALARM

7.1 General

7.1.1 Purpose

The purpose of this Chapter is to detect a fire in the space of origin and to provide for alarm for safe escape and fire-fighting activity. For this purpose, the following functional requirements are to be met:

(1) Fire detection and alarm system installations are to be suitable for the nature of the space, fire growth potential and potential generation of smoke and gases;

(2) Manually operated call points are to be placed effectively to ensure a readily accessible means of notification.

7.2 General Requirements

7.2.1 Fixed Fire Detection and Fire Alarm System

1. A fixed fire detection and fire alarm system is to be provided in accordance with the following provisions of this Chapter.

2. A fixed fire detection and alarm system and a sample extraction smoke detection system required in this Part is to be of an approved type and comply with **Chapters 29** or **30**.

3. Where a fixed fire detection and fire alarm system is required for the protection of spaces other than those specified in **7.5**, at least one detector which is of an approved type and complying with **Chapter 29** is to be installed in each such space.

7.3 Test

7.3.1 Initial and Periodical Test

1. The function of fixed fire detection and fire alarm systems required by the relevant provisions of this Part are to be tested under varying conditions of ventilation after installation.

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

7.4 Protection of Machinery Spaces

7.4.1 Installation

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

(1) Periodically unattended machinery spaces;

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

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

(4) enclosed spaces containing incinerators

2. For the protection of the machinery spaces defined in **-1(1)** above, the following means are to be provided.

(1) Manually operated call points are to be installed in:

(a) At least two places near by entrances of the passageways with access door openings to spaces where main propulsion machinery, boilers, electric generating sets, etc. are installed;

(b) Wheel house or centralized monitoring and control stations on bridge, and

(c) Centralized control stations for main propulsion, including the stations placed in machinery spaces where main propulsion is installed.

(2) Where a switch to open temporarily a specific circuit of fire detection systems is fitted, means are to be provided to indicate such a condition clearly and to restore the circuit automatically after elapsing a preset period of time.

(3) In case where fire detectors are provided with means to adjust their sensitivity, the arrangements are to be capable of fixing and identifying the set point.

7.4.2 Design

The fixed fire detection and fire alarm system required in 7.4.1 is to be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures.

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

7.5 Protection of Accommodation and Service Spaces and Control Stations

7.5.1 Fire Detection and Fire Alarm Systems

Accommodation and service spaces and control stations of ships are to be protected by a fixed fire detection and fire alarm system and/or an automatic sprinkler, fire detection and fire alarm system as follows depending on a protection method adopted in accordance with **9.2.2.** Where deemed necessary by the Society, additional smoke detectors in ventilation ducts may be required.

(1) Method I*C*

A fixed fire detection and fire alarm system is to be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces.

(2) Method II*C*

An automatic sprinkler, fire detection and fire alarm system of a type deemed appropriate by the Society and complying with the relevant requirements of **Chapter 28** is to be so installed and arranged as to protect accommodation spaces, galleys and other service spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc. In addition, a fixed detection and fire alarm system is to be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces.

(3) Method III*C*

A fixed fire detection and fire alarm system is to be so installed and arranged as to detect the presence of fire in all accommodation spaces and service spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc. In addition, a fixed fire detection and fire alarm system is to be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces.

7.5.2 Manually Operated Call Points

Manually operated call points complying with **Chapter 29** are to be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point is to be located at each exit. Manually operated call points are to be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 *m* from a manually operated call point.

7.6 Protection of Cargo Spaces

7.6.1 Fire Detection and Fire Alarm Systems

A fixed fire detection and fire alarm system or a sample extraction smoke detection system is to be provided in any cargo space except those subject to the provisions of **10.7.1-2.**

Chapter 8 CONTROL OF SMOKE SPREAD

8.1 General

8.1.1 Purpose

The purpose of this Chapter is to control the spread of smoke in order to minimize the hazards from smoke. For this purpose, means for controlling smoke in atriums, control stations, machinery spaces and concealed spaces are to be provided.

8.2 Protection of Control Stations

8.2.1 Protection of Control Stations outside Machinery Spaces

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

8.3 Release of Smoke

8.3.1 Release of Smoke from Machinery Spaces

1. The provisions of **8.3.1** are to apply to machinery spaces of category A and, in principle, to other machinery spaces.

2. Suitable arrangements are to be made to permit the release of smoke, in the event of fire, from the space to be protected, subject to the provisions of **9.5.2-1**. The normal ventilation systems may be acceptable for this purpose.

3. Means of control are to be provided for permitting the release of smoke and the controls are to be located outside the space concerned so that they will not be cut off in the event of fire in the space they serve.

4. The controls required by **-3** above are to be situated at one control position or grouped in as few positions as possible to the satisfaction of the Society. Such positions are to have a safe access from the open deck.

8.4 Draught Stops

8.4.1 General

Air spaces enclosed behind ceilings, paneling or linings are to be divided by close-fitting draught stops spaced not more than 14 *m* apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., are to be closed at each deck.

Chapter 9 CONTAINMENT OF FIRE

9.1 General

9.1.1 Purpose

The purpose of this Chapter is to contain a fire in the space of origin. For this purpose, the following functional requirements are to be met:

(1) The ship is to be subdivided by thermal and structural boundaries;

(2) Thermal insulation of boundaries is to have due regard to the fire risk of the space and adjacent spaces; and

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

9.2 Thermal and Structural Boundaries

9.2.1 Thermal and Structural Subdivision

Ships of all types are to be subdivided into spaces by thermal and structural divisions having regard to fire risk of the space.

9.2.2 Methods of Protection in Accommodation Area

1. One of the following methods of protection is to be adopted in accommodation and service spaces and control stations:

(1) Method I*C*

The construction of internal divisional bulkheads of non-combustible *"B*" or "*C*" class divisions generally without the installation of an automatic sprinkler, fire detection and fire alarm system in the accommodation and service spaces;

(2) Method II*C*

The fitting of an automatic sprinkler, fire detection and fire alarm system as required by 7.5.1**(2)** for the detection and extinction of fire in all spaces in which fire might be expected to originate, generally with no restriction on the type of internal divisional bulkheads; or

(3) Method III*C*

The fitting of a fixed fire detection and fire alarm system as required by 7.5.1**(3)**, in spaces in which a fire might be expected to originate, generally with no restriction on the type of internal divisional bulkheads, except that in no case must the area of any accommodation space or spaces bounded by an "*A*" or *"B"* class division exceed 50 m^2. Consideration may be given by the Society to increasing this area for public spaces.

2. The requirements for the use of non-combustible materials in the construction and insulation of boundary bulkheads of machinery spaces, control stations, service spaces, etc., and the protection of the above stairway enclosures and corridors will be common to all three methods outlined in **-1** above.

9.2.3 Bulkheads and Decks

1. Bulkheads required to be "*B*" class divisions are to extend from deck to deck and to the shell or other boundaries. However, where a continuous *"B"* class ceiling or lining is fitted on both sides of the bulkhead, the bulkhead may terminate at the continuous ceiling or lining. Bulkheads not required by this or other Chapters to be "*A*" or *"B"* class divisions, are to be as follows:

(1) Method I*C*

These bulkheads are to be of at least "*C*" class construction.

(2) Method II*C*

There is no restriction on the construction of these bulkheads except in individual cases where "*C*" class bulkheads are required in accordance with **Table 9.1.**

(3) Method III*C*

There is no restriction on the construction of these bulkheads except in individual cases where "*C*" class bulkheads are required in accordance with **Table 9.1.**

2. In addition to complying with the specific provisions for fire integrity of bulkheads and decks, for the minimum fire integrity of bulkheads and decks, **Tables 9.1** and **9.2** are to apply respectively to the bulkheads and decks separating adjacent spaces. For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (**1**) to (**11**) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this Chapter, or where it is possible to assign two or more classifications to a space, it is to be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30% communicating openings to that space are to be considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms is to be as prescribed in **Tables 9.1** and **9.2.** The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables.

(1) Control stations

Spaces containing emergency sources of power and lighting

Wheelhouse and chartroom

Spaces containing the ships radio equipment

Fire control stations

Control room for propulsion machinery when located outside the machinery space

Spaces containing centralized fire alarm equipment

(2) Corridors

Corridors and lobbies

(3) Accommodation spaces

Spaces as defined in **3.2.1**, excluding corridors

(4) Stairways

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

(5) Service spaces (low risk)

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

(6) Machinery spaces of category *A*

Spaces as defined in **3.2.31**

(7) Other machinery spaces

Electrical equipment rooms (auto-telephone exchange, air-conditioning duct spaces) Spaces as defined in **3.2.30** excluding machinery spaces of category *A*.

(8) Cargo spaces

All spaces used for cargo (including cargo oil tanks) and trunkways and hatchways to such spaces.

(9) Service spaces (high risk)

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

(10) Open decks

Open deck spaces and enclosed promenades having little or no fire risk. To be considered in this category, enclosed promenades are to have no significant fire risk, meaning that furnishings are to be restricted to deck furniture. In addition, such spaces are to be naturally ventilated by permanent openings.

Air spaces (the space outside superstructures and deckhouses).

(11) RO-RO and vehicle spaces

RO-RO spaces as defined in **3.2.41**

Vehicle spaces as defined in **3.2.49.**

Table 9.1 Fire Integrity of Bulkheads separating adjacent spaces

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

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

4. External boundaries which are required in **11.2** to be of steel or other equivalent material may be pierced for the fitting of windows and side scuttles provided that there is no requirement for such boundaries of cargo ships to have "*A"* class integrity. Similarly, in such boundaries which are not required to have *"A"* class integrity, doors may be constructed of materials which are to the satisfaction of the Society.

5. Saunas are to comply with the following requirements:

(1) The perimeter of the sauna is to be of "*A*" class boundaries and may include changing rooms, showers and toilets.

The sauna is to be insulated to "*A*-60" standard against other spaces except those inside of the perimeter and spaces of categories **(5), (9)** and **(10)** of **9.2.3-2**.

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

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

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

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

(6) Electrically heated ovens are to be provided with a timer.

6. Protection of stairways and lift trunks in accommodation spaces, service spaces and control stations

(1) Stairways which penetrate only a single deck are to be protected, at a minimum, at one level by at least "*B*-0" class divisions and self-closing doors. Lifts which penetrate only a single deck are to be surrounded by "*A*-0" class divisions with steel doors at both levels. Stairways and lift trunks which penetrate more than a single deck are to be surrounded by at least "*A*-0" class divisions and be protected by self-closing doors at all levels.

(2) On ships having accommodation for 12 persons or less, where stairways penetrate more than a single deck and where there are at least two escape routes direct to the open deck at every accommodation level, the Society may permit the "*A*-0" requirements of **(1)** above be reduced to "*B*-0" .

Table 9.2 Fire Integrity of Decks separating adjacent spaces

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

Note: To be applied to **Tables 9.1** and **9.2** as appropriate.

a. No special requirements are imposed upon bulkheads in methods II*C* and III*C* fire protection.

b. In case of method III*C*, "*B"* class bulkheads of "*B*-0" rating are to be provided between spaces or groups of spaces of 50 m^2 and over in area.

c. For clarification as to which applies, see **9.2.3-1** and **9.2.3-6**.

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

e. Bulkheads separating the wheelhouse, chartroom and radio room from each other may have a "*B*-0" rating.

f. An "*A*-0" rating may be used if no dangerous goods are intended to be carried or if such goods are stowed not less than 3 *m* horizontally from such bulkhead.

g. For cargo spaces in which dangerous goods are intended to be carried, **19.3.8** applies.

h. Bulkheads and decks separating ro-ro and/or vehicle spaces are to be capable of being closed reasonably gas-tight and such division is to have "*A"* class integrity in so far as reasonable and practicable in the opinion of the Society.

i. Fire insulation need not be fitted if the machinery in category **(7),** in the opinion of the Society, it has little or no fire risk.

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

9.2.4 Tankers

1. For tankers, only method IC as defined in **9.2.2-1** is to be used.

2. In lieu of **9.2.3-2** and in addition to complying with the specific provisions for fire integrity of bulkheads and decks of tankers, for the minimum fire integrity of bulkheads and decks, **Tables 9.3** and **9.4** are to apply respectively to the bulkhead and decks separating adjacent spaces. For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories **(1)** to **(10)** below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this regulation, or where it is possible to assign two or more classifications to a space, it is to be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed areas within a space that have less than 30% communicating openings to that space are to be considered separate areas. The fire integrity of the boundary bulkheads and decks of such smaller spaces is to be as prescribed in **Tables 9.3** and **9.4**. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables.

(1) Control stations
  (a) Spaces containing emergency sources of power and lighting Wheelhouse and chartroom
  (b) Spaces containing the ships radio equipment
  (c) Fire control stations
  (d) Control room for propulsion machinery when located outside the machinery space
  (e) Spaces containing centralized fire alarm equipment

(2) Corridors
  (a) Corridors and lobbies

(3) Accommodation spaces
  (a) Spaces as defined in **3.2.1**, excluding corridors

(4) Stairways

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

(5) Service spaces (low risk)

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

(6) Machinery spaces of category *A*

Spaces as defined in **3.2.31**

(7) Other machinery spaces

Electrical equipment rooms (auto-telephone, exchange, air-conditioning duct spaces)

Spaces as defined in **3.2.30** excluding machinery spaces of category *A*

(8) Cargo pump-rooms

Spaces containing cargo pumps and entrances and trunks to such spaces.

(9) Service spaces (high risk)

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

(10) Open decks

Open deck spaces and enclosed promenades having little or no fire risk. To be considered in this category, enclosed promenades are to have no significant fire risk, meaning that furnishings are to be restricted to deck furniture. In addition, such spaces are to be naturally ventilated by permanent openings. Air spaces (the space outside superstructures and deckhouses)

3. Exterior boundaries of superstructures and deckhouses enclosing accommodation and including any overhanging decks which support such accommodation are to be constructed of steel and insulated to "*A*-60" standard for the whole of the portions which face the cargo area and on the outward sides for a distance of 3 *m* from the end boundary facing the cargo area. The distance of 3 *m* is to be measured horizontally and parallel to the middle line of the ship from the boundary which faces the cargo area at each deck level. In the case of the sides of those superstructures and deckhouses, such insulation is to be carried up to the underside of the deck of the navigation bridge.

4. Skylights to cargo pump-rooms are to be of steel, are not to contain any glass and are to be capable of being closed from outside the pump-room.

Table 9.3 Fire Integrity of Bulkheads separating adjacent spaces (for Tankers)

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

Table 9.4 Fire Integrity of Decks separating adjacent spaces (for Tankers)

Spaces Spaces		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control stations	(1)	*A*-0	*A*-0	*A*-0	*A*-0	*A*-0	*A*-60	*A*-0	-	*A*-0	*
Corridors	(2)	*A*-0	*	*	*A*-0	*	*A*-60	*A*-0	-	*A*-0	*
Accommodation spaces	(3)	*A*-60	*A*-0	*	*A*-0	*	*A*-60	*A*-0	-	*A*-0	*
Stairways	(4)	*A*-0	*A*-0	*A*-0	*	*A*-0	*A*-60	*A*-0	-	*A*-0	*
Service spaces(low risk)	(5)	*A*-15	*A*-0	*A*-0	*A*-0	*	*A*-60	*A*-0	-	*A*-0	*
Machinery spaces of category A	(6)	*A*-60	*A*-60	*A*-60	*A*-60	*A*-60	*	*A*-60[e]	*A*-0	*A*-60	*
Other machinery Spaces	(7)	*A*-15	*A*-0	*A*-0	*A*-0	*A*-0	*A*-0	*	*A*-0	*A*-0	*
Cargo pump rooms	(8)	-	-	-	-	-	*A*-0[d]	*A*-0	*	-	*
Service spaces(high risk)	(9)	*A*-60	*A*-0	*A*-0	*A*-0	*A*-0	*A*-60	*A*-0	-	*A*-0[b]	*
Open decks	(10)	*	*	*	*	*	*	*	*	*	-

Notes: To be applied to **Tables 9.3** and **9.4** as appropriate.

a. For clarification as to which applies, see **9.2.3-1** and **9.2.3-6.**

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

c. Bulkheads separating the wheelhouse, chartroom and radio room from each other may have a "*B*-0" rating.

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

e. Fire insulation need not be fitted if the machinery space in category **(7),** in the opinion of the Society, it has little or no fire risk.

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

9.3 Penetration in Fire-resisting Divisions and Prevention of Heat Transmission

9.3.1 Penetration in "*A"* Class Divisions

Where "*A*" class divisions are penetrated, such penetrations are to be tested and approved by the Society or organizations deemed appropriate by the Society, in accordance with the Fire Test Procedures Code. In the case of ventilation ducts, **9.7.1-2** and **9.7.3-1** are to apply. However, where a pipe penetration made of steel or equivalent material having a thickness of 3 *mm* or greater and a length of not less than 900 *mm* (preferably 450 *mm* on each side of the division), and no openings, testing is not required. Such penetrations are to be suitably insulated by extension of the insulation at the same level of the division.

9.3.2 Penetration in B Class Divisions

Where B class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc., or for the fitting of ventilation terminals, lighting fixtures and similar devices, arrangements are to be made to ensure that the fire resistance is not impaired, subject to the provisions of **9.7.3-2**. Pipes other than steel or copper that penetrate "*B"* class divisions are to be protected by either:

(1) A penetration device tested and approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code, suitable for the fire resistance of the division pierced and the type of pipe used; or

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

9.3.3 Penetration of Pipes

Uninsulated metallic pipes penetrating "*A"* or "*B"* class divisions are to be of materials having a melting temperature which exceeds 950ºC for "*A*-0" and 850º*C* for "*B*-0" class divisions.

9.3.4 Prevention of Heat Transmission

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

9.4 Protection of Openings in Fire Resisting Divisions

9.4.1 Doors in Fire-resisting Divisions

The fire resistance of doors is to be equivalent to that of the division in which they are fitted, this being approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code. Doors and door frames in "*A*" class divisions are to be constructed of steel. Doors in "*B*" class divisions are to be non-combustible. Doors fitted in boundary bulkheads of machinery spaces of category "*A*" are to be reasonably gas tight and self-closing. In ships constructed according to method I*C*, the Society may permit the use of combustible materials in doors separating cabins from individual interior sanitary accommodation such as showers.

9.4.2 Doors of Self-closing Type

Doors required to be self-closing are not to be fitted with holdback hooks. However, hold-back arrangements fitted with remote release devices of the fail-safe type may be utilized.

9.4.3 Ventilation Openings

1. Balancing openings or ducts (hereinafter, referred to as ventilation openings) in fire resisting divisions between two enclosed spaces are prohibited except for openings specified in **-2** below.

2. In corridor bulkheads, ventilation openings may be permitted in and under the doors of cabins and public spaces. Ventilation openings are also permitted in "*B"* class doors leading to lavatories, offices, pantries, lockers and store rooms. Except as permitted below, the openings are to be provided only in the lower half of a door. Where such

opening is in or under a door the total net area of any such opening or openings is not to exceed 0.05 m^2. Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, and located below the sanitary unit is permitted where the cross-sectional area of the duct does not exceed 0.05 m^2. Ventilation openings, except those under the door, are to be fitted with a grille made of non-combustible material.

9.4.4 Fire Integrity for Watertight Doors

Watertight doors which are required to be watertight need not be tested in accordance with the Fire Test Procedure Codes provided that such doors are to be designed and made to keep reasonable fire integrity.

9.5 Protection of Openings in Machinery Spaces Boundaries

9.5.1 Application

The provision of **9.5** is to apply to machinery spaces of category "*A*" and, in principle, to other machinery spaces.

9.5.2 Protection of Openings in Machinery Space Boundaries

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

2. Skylights are to be of steel and are not to contain glass panels.

3. Means of control are to be provided for closing power-operated doors or actuating release mechanism on doors other than power-operated watertight doors. The control is to be located outside the space concerned, where they will not be cut off in the event of fire in the space it serves.

4. Windows are not to be fitted in machinery space boundaries. However, this does not preclude the use of glass in control rooms within the machinery spaces.

5. When access to any machinery spaces of category *A* from an adjacent shaft tunnel is provided at a low level, a light steel fire-screen door operable from each side is to be provided in the shaft tunnel, near the watertight door.

9.6 Protection of Cargo Space Boundaries

9.6.1 Cargo Space Boundaries in Tankers

In tankers, for the protection of cargo tanks carrying crude oil and petroleum products having a flashpoint not exceeding 60^oC, materials readily rendered ineffective by heat are not to be used for valves, fittings, tank opening covers, cargo vent piping, and cargo piping so as to prevent the spread of fire to the cargo.

9.7 Ventilation Systems

9.7.1 General

1. Ventilation ducts, including and double wall ducts, are to be of non-combustible material. Except flexible bellows of short of length not exceeding 600mm used for connecting fans to the ducting in air-conditioning room. Unless expressly provided otherwise in 9.7.1-6, any other material used in the construction of ducts, including insulation, is also to be non-combustible.

However, short ducts, not generally exceeding 2 *m* in length and with a free cross-sectional area not exceeding 0.02 m^2, need not be steel or equivalent, subject to the following conditions:

(1) The ducts are to be made of non-combustible; which material may be faced internally and externally with membranes having low flame-spread the thickness used;

(2) The ducts are only used at the end of the ventilation device; and

(3) The ducts are not to be situated less than 600 *mm*, measured along the duct, from an opening in an "*A"* or "*B"* class division including continuous "*B"* class ceiling.

2. The following arrangements are to be tested and approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code:

(1) Fire dampers, including relevant means of operation; However, the testing is not required for dampers located at the lower end of the duct in exhaust duct for galley ranges, which must be of steel and capable of stopping the draught in the duct; and

(2) Duct penetrations through "*A"* class divisions. However, the test is not required where steel sleeves are directly joined to ventilation ducts by means of riveted or screwed connections or by welding.

3. Fire damper are to be easily accessible. Where they are placed behind ceiling or linings, these ceiling or linings are to be provided with an inspiration hatch the identification number of the fire damper is marked. The fire damper identification number is also to be marked on any remote controls provided.

4. Ventilation ducts are to provide with hatches for inspection and cleaning. The hatches are to be located near the fire dampers.

5. The main inlets and outlets of ventilation systems are to be easily accessible as well as prominently and permanently marked and are to indicate the operating position of the closing device.

6. Combustible gasket in flanged ventilation duct connections are not permitted within 600 mm of opening in "A" or "B" class divisions and in ducts required to be of "A" class construction.

7. Ventilation opening or air balance ducts between two enclosed spaces are not to be provided, except as permitted by 9.4.3-2.

9.7.2 Arrangement of Ducts

1. The ventilation systems for machinery spaces of category "*A*", vehicle spaces, ro-ro spaces, galleys, special category spaces and cargo spaces are, in general, to be separated from each other and from the ventilation systems serving other spaces. Except that the galley ventilation systems on cargo ships of less than 4,000 *gross tonnages*,

need not be completely separated, but may be served by separate ducts from a ventilation unit serving other spaces. In such case, an automatic fire damper is to be fitted in the galley ventilation duct near the ventilation unit. Ducts provided for the ventilation of machinery spaces of category *A*, galleys, vehicle spaces, ro-ro spaces or special category spaces are not to pass through accommodation spaces, service spaces or control stations unless they comply with the conditions specified in (**1**) or (**2**) below:

(1) In the case of fire dampers installed

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

(b) The ducts are suitably supported and stiffened;

(c) The ducts are fitted with automatic fire dampers close to the boundaries penetrated; and

(d) The ducts are insulated to "*A*-60" class standard from the machinery spaces, galleys, vehicle spaces, RO-RO spaces or special category spaces to a point at least 5 *m* beyond each fire damper.

(2) In the case of fire dampers not installed

(a) The ducts are constructed of steel in accordance with (**a**) and (**b**) of (**1**) above; and

(b) The ducts are insulated to "*A*-60" class standard throughout the accommodation spaces, service spaces or control stations.

2. Ducts provided for ventilation to accommodation spaces, service spaces or control stations are not to pass through machinery spaces of category "*A*" galleys, vehicle spaces, ro-ro spaces or special category spaces unless they comply with the conditions specified in (**1**) or (**2**) below:

(1) In the case of fire dampers installed

(a) The ducts where they pass through a machinery space of category *A*, galley, vehicle space, ro-ro space or special category space are constructed of steel in accordance with (**a**) and (**b**) of **-1**(**1**) above;

(b) Automatic fire dampers are fitted close to the boundaries penetrated; and

(c) The integrity of the machinery space, galley, vehicle space, RO-RO space or special category space boundaries is maintained at the penetrations.

(2) In the case of fire dampers not installed

(a) The ducts where they pass through a machinery space of category *A*, galley, vehicle space, ro-ro space or special category space are constructed of steel in accordance with (**a**) and (**b**) of **-1**(**1**) above; and

(b) The ducts are insulated to "*A*-60" class standard within the machinery space, galley, vehicle space, ro-ro space or special category space.

9.7.3 Details of Duct Penetrations

1. Duct passing through "A" class divisions are to meet the following requirements:

(1). Where a thin plated duct with a free sectional area equal to, or less than, 0.02 m^2 passes through "*A*" class divisions, the opening is to be fitted with a steel sheet sleeve having a thickness of at least 3 *mm* and a length

of at least 200 *mm*, divided preferably into 100 *mm* on each side of the bulkhead or, in the case of the deck, totally laid on the lower side of the decks pierced.

(2) Where ventilation ducts with a free-sectional area exceeding 0.02 m^2, but not more than 0.075m^2 pass through "*A"* class division, the opening is to be lined with a steel sheet sleeve. The ducts and sleeves are to have a thickness of at least 3 *mm* and a length of at least 900 *mm*. When passing through bulkheads, this length is to be divided preferably into 450 *mm* on each side of the bulkhead. These ducts, or sleeves lining such ducts, are to be provided with fire insulation. The insulation is to have at least the same fire integrity as the division through which the duct passes; and

(3) Automatic fire dampers are to be fitted in all ducts with a free cross-sectional area exceeding 0.075 m^2 are to be fitted with fire dampers in addition to the requirements of (**1**) above. The fire damper is to operate automatically but is also to be capable of being closed manually from both sides of the bulkhead or deck. The damper is to be fitted with a~~n~~ visible indicator which shows the operating position of the. Fire dampers are not required, however, where ducts pass through spaces surrounded by "*A"* class divisions, without serving those spaces, provided those ducts have the same fire integrity as the divisions which they penetrate. A duct of cross sectional area exceeding 0.075 m^2 is not to be divided into smaller ducts at the penetration of an "A" class division and then recombined intro the original duct once through the division to avoid installing the damper required by this paragraph **2**. Ventilation ducts with a free cross-sectional area exceeding 0.02 m^2 passing through "*B"* class bulkheads are to be lined with steel sheet sleeves of 900 *mm* in length divided preferably into 450 *mm* on each side of the bulkheads unless the duct is of steel for this length.

3. All fire dampers are to be capable of manual operation. The dampers are to have a direct mechanical means of release or, alternatively, be closed by electrical, hydraulic, or pneumatic operation. All dampers are to be manually operable from both sides of the division. Automatic fire dampers, including those capable of remote operation, are to have a failsafe mechanism that will close the damper in a fire even upon loss of electrical power or hydraulic or pneumatic pressure loss. Remotely operated fire dampers are to be capable of being reopened manually at the damper.

9.7.4 Exhaust Ducts from Galley Ranges

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

(1) A grease trap readily removable for cleaning;

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

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

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

9.7.5 Ventilation rooms serving machinery spaces of category. A containing internal combustion machinery.

1. Where a ventilation room serves only such an adjacent machinery space and there is no fire division between the ventilation room and the machinery space, the means for closing the ventilation duct or ducts serving the machinery space is to be located outside of the ventilation room and machinery space.

2. Where a ventilation room serves such a machinery space as well as other spaces and is separated from the machinery space by an "A-0" class division, including penetrations, the means for closing the ventilation duct or ducts for the machinery space can be located in the ventilation room.

Chapter 10 FIRE FIGHTING

10.1 General

10.1.1 Purpose

1. The purpose of this Chapter is to suppress and swiftly extinguish a fire in the space of origin except for -2 below. For this purpose, the following functional requirements are to be met:

(1) Fixed fire extinguishing systems are to be installed having due regard to the fire growth potential of the protected spaces; and

(2) Fire extinguishing appliances are to be readily available.

2. For open-top container holds and on deck container stowage areas on ships designed to carry containers on or above the weather deck, fire protection arrangements are to be provided for the purpose of containing a fire in the space or area of origin and cooling adjacent areas to prevent fire spread and structural damage.

10.1.2 General Requirements

Ships are to be provided with fire pumps, fire mains, hydrants and hoses complying with the applicable requirements of this Chapter.

10.2 Water Supply Systems

10.2.1 Fire Mains and Hydrants

1. General

Materials readily rendered ineffective by heat are not to be used for fire mains and hydrants unless adequately protected. The pipes and hydrants are to be so placed that the fire hoses may be easily coupled to them. The arrangement of pipes and hydrants is to be such as to avoid the possibility of freezing. Suitable drainage provisions are to be provided for all fire main piping. Isolation valves are to be installed for all open deck fire main branches

used for purposes other than firefighting. In ships where deck cargo may be carried, the positions of the hydrants are to be such that they are always readily accessible and the pipes are to be arranged as far as practicable to avoid risk of damage by such cargo.

2. Ready availability of water supply

With a periodically unattended machinery space or when only one person is required on watch, there is to be immediate water delivery from the fire main system at a suitable pressure, either by remote starting of one of the main fire pumps with remote starting from the navigating bridge and fire control station, if any, or permanent pressurization of the fire main system by one of the main fire pumps, except that the Society may waive this requirement for ships of less than 1,600 *gross tonnage* if the fire pump starting arrangement in the machinery space is in an easily accessible position.

3. Diameter of fire mains

The diameter of the fire main and water service pipes is to be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously, except that in the case of cargo ships, other than those included in **10.7.3-2**, the diameter need only be sufficient for the discharge of 140 m^3/h.

4. Isolating valves and relief valves

(1) Isolating valves to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main are to be fitted in an easily accessible and tenable position outside the machinery spaces. The fire main is to be so arranged that when the isolating valves are shut all the hydrants on the ship, except those in the machinery space referred to above, can be supplied with water by another fire pump or an emergency fire pump. The emergency fire pump, its seawater inlet, and suction and delivery pipes and isolating valves are to be located outside the machinery space. If this arrangement cannot be made, the sea-chest may be fitted in the machinery space if the valve is remotely controlled from a position in the same compartment as the emergency fire pump and the suction pipe is as short as practicable. Short lengths of suction or discharge piping may penetrate the machinery space, provided they are enclosed in a substantial steel casing, or are insulated to "*A*-60" class standards. The pipes are to have substantial wall thickness, in no case less than 11 *mm*, and are to be all welded except for the flanged connection to the sea inlet valve.

(2) A valve is to be fitted to serve each fire hydrant so that any fire hose may be removed while the fire pumps are in operation.

(3) Relief valves are to be provided in conjunction with all fire pumps if the pumps are capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants and hoses. These valves are to be so placed and adjusted as to prevent excessive pressure in any part of the fire main system.

(4) In tankers, isolation valves are to be fitted in the fire main at poop front in a protected position and on the tank deck at intervals of not more than 40 *m* to preserve the integrity of the fire main system in case of fire or explosion.

5. Number and position of hydrants

The number and position of hydrants are to be such that at least two jets of water not emanating from the same hydrant, one of which is to be from a single length of hose, may reach any part of the ship normally accessible to the passengers or crew while the ship is being navigated and any part of any cargo space when empty, any RO-RO space or any vehicle space in which latter case the two jets are to reach any part of such space, each from a single length of hose. Furthermore, such hydrants are to be positioned near the accesses to the protected spaces.

6. Pressure at hydrants

(1) With the two pumps simultaneously delivering water through the nozzles specified in **10.2.3-3**, with the quantity of water specified in **10.2.1-3**, through any adjacent hydrants, the following minimum pressures is to be maintained at all hydrants:

(e) 6,000 gross tonnage and upwards 0.27 N/mm^2

(f) Less than 6,000 gross tonnage 0.25 *N/mm*^{2}

(2) The maximum pressure at any hydrant is to not exceed that at which the effective control of a fire hose can be demonstrated.

7. International shore connections

(1) Ships are to be provided with at least one international shore connection complying with the requirements of **Chapter 22**.

(2) Facilities are to be available enabling such a connection to be used on either side of the ship.

10.2.2 Fire Pumps

1. Pumps accepted as fire pumps

Sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil and that if they are subject to occasional duty for the transfer or pumping of oil fuel, suitable change-over arrangements are fitted.

2. Number of fire pumps

Ships are to be provided with fire pumps as follows:

(1) For ships of 1,000 *gross tonnage* and upwards, at least two sets of independently power driven fire pumps; and

(2) For ships of less than 1,000 *gross tonnages*, at least two sets of power driven pumps, one of which is to be independently driven.

3. Arrangement of fire pumps and fire mains

(1) For the arrangement of sea connections, fire pumps and their sources of power, if a fire in any one compartment could put all the pumps out of action, there are to be an alternative means consisting of an fixed emergency fire pump complying with the provisions of the requirements of **Chapter 32** with its source of power and sea connection located outside the space where the main fire pumps or their source of power are located.

(2) The space containing the emergency fire pump is to be located behind the forward collision bulkhead and not be contiguous to the boundaries of machinery spaces of category *A* or those spaces containing main fire pumps. Where the latter is not practicable, the common bulkhead between the two spaces is to be insulated to a standard of structural fire protection equivalent to that required for a control station in **9.2.3**.

(3) No direct access is to be permitted between the machinery space and the space containing the emergency fire pump and its source of power. When this is impracticable, the access may be by means of an airlock with the door of the machinery space being of "*A*-60" class standard, and the other door being at least steel, both reasonably gas tight, self-closing and without any hold back arrangements. Alternatively, the access may be through a watertight door capable of being operated from a space remote from the machinery space and the space containing the emergency fire pump and unlikely to be cut off in the event of fire in those spaces. In such cases, a second means of access to the space containing the emergency fire pump and its source of power are to be provided.

(4) Ventilation arrangements to the space containing the independent source of power for the emergency fire pump are to be such as to preclude, as far as practicable, the possibility of smoke from a machinery space fire entering or being drawn into that space.

(5) In addition, in ships where other pumps, such as general service, bilge and ballast, etc., are fitted in a machinery space, arrangements is to be made to ensure that at least one of these pumps, having the capacity and pressure required by **10.2.1-6(1)** and **10.2.2-4(2),** is capable of providing water to the fire main.

(6) In ships classed for navigation in ice, fire pumps are to be arranged to the satisfaction of the Society.

4. Capacity of fire pumps

(1) The pumps required by **10.2.2**, other than any emergency pump, are to be capable of delivering the quantity of water not less than four thirds of the quantity required by **13.5.4-2**, **Part 7** of the Rules to be dealt with by each of the independent bilge pumps in a ship of the same dimension when employed in bilge pumping, at the pressure specified in **10.2.1-6**, provided that in no ship, other than those included in **10.7.3-2**, need the total required capacity of the fire pumps exceed 180 m^3/h.

(2) Each of the fire pumps required by **10.2.2** (other than any emergency pump) are to have a capacity not less than 80% of the total capacity which is required by **(1)** above divided by the minimum number of fire pumps required by **-2** above but in any case not less than 25 m^3/h, and each such pump is to in any event be capable of delivering at least the two jets of water required by **10.2.1-5**. These fire pumps are to be capable of supplying the fire main system under the conditions required by **10.2.1-6**. Where more pumps than the minimum of pumps required by **-2** above are installed, such additional pumps are to have a capacity of at least 25 m^3/h and are to be capable of delivering at least the two jets of water required by **10.2.1-5**.

10.2.3 Fire Hoses and Nozzles

1. General specifications

(1) Fire hoses are to be of non-perishable material approved by the Society, are to have sufficient strength for expected pressure in operation and are to be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Each hose is to be provided with a nozzle and the necessary couplings. Fire hoses are, together with any necessary fittings and tools, to be kept ready for use in conspicuous positions near the water service hydrants or connections. Fire hoses are to have a length of at least 10 *m*, but not more than:

(a) 15 *m* in machinery spaces;

(b) 20 *m* in other spaces and open decks; and

(c) 25 *m* for open decks on ships with a maximum breadth in excess of 30 *m*.

(2) Unless one hose and nozzle is provided for each hydrant in the ship, there is to be complete interchangeability of hose couplings and nozzles.

2. Number and diameter of fire hoses Ships are to be provided with fire hoses as follows:

(1) For ships of 1,000 *gross tonnage* and upwards, the number of fire hoses to be provided is to be one for each 30 *m* length of the ship and one spare but in no case less than five in all. This number does not include any hoses required in any machinery spaces of category *A*. The Society may increase the number of hoses required so as to ensure that hoses in sufficient number are available and accessible at all times, having regard to the type of ship and the nature of trade in which the ship is employed.

(2) For ships of less than 1,000 *gross tonnages*, the number of fire hoses to be provided is to be calculated in accordance with the provisions of **(1)** above. However, the number of hoses is to in no case be less than three.

(3) All hydrants in machinery spaces of category *A* are to be fitted with hoses having nozzles.

(4) Ships carrying dangerous goods in accordance with **Chapter 19** are to be provided with 3 hoses and nozzles, in addition to those required above.

3. Size and types of nozzles

(1) For the purposes of this chapter, standard nozzle sizes are to be 12 *mm*, 16 *mm* and 19 *mm* or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Society.

(2) For accommodation and service spaces, a nozzle size greater than 12 *mm* need not be used.

(3) For machinery spaces and exterior locations, the nozzle size is to be such as to obtain the maximum discharge possible from two jets at the pressure mentioned in **10.2.1-6** from the smallest pump, provided that a nozzle size greater than 19 *mm* need not be used.

(4) Nozzles are to be of an approved dual-purpose type (i.e., spray/jet type) incorporating a shutoff.

10.3 Portable Fire Extinguishers

10.3.1 Type and Design

Portable fire extinguishers are to comply with the requirements of **Chapter 24**.

10.3.2 Arrangement of Fire Extinguishers

1. Accommodation spaces, service spaces and control stations are to be provided with portable fire extinguishers of appropriate types and in sufficient number to the satisfaction of the Society. Ships of 1,000 *gross tonnage* and upwards are to carry at least five portable fire extinguishers. Ships of less than 1,000 *gross tonnages* are to carry at least four portable fire extinguishers.

2. One of the portable fire extinguishers intended for use in any space is to be stowed near the entrance to that space.

3. Carbon dioxide fire extinguishers are not to be placed in accommodation spaces. In control stations and other spaces containing electrical or electronic equipment or appliances necessary for the safety of the ship, fire extinguishers are to be provided whose extinguishing media are neither electrically conductive nor harmful to the equipment and appliances.

4. Fire extinguishers are to be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of a fire, and in such a way that their serviceability is not impaired by the weather, vibration or other external factors. Portable fire extinguishers are to be indicated whether they have been used or not used.

5. Two portable fire extinguishers which are to be as deemed appropriate by the Society are to be provided on weather deck within the cargo area for tankers.

10.3.3 Spare Charges

1. Spare charges are to be provided for 100% of the first 10 extinguishers and 50% of the remaining fire extinguishers capable of being recharged on board. Not more than 60 total spare charges are required. Instructions for recharging are to be carried on board.

2. For fire extinguishers which cannot be recharged onboard, additional portable fire extinguishers of the same quantity, type, capacity and number as determined in **-1** above are to be provided in lieu of spare charges.

10.4 Fixed Fire-extinguishing Systems

10.4.1 General

1. Unless otherwise specified, the requirements of **10.4** apply to fixed fire-extinguishing systems required by the provisions of **10.5**, **10.7** and **10.9**.

2. Where a fixed fire-extinguishing system not required by this chapter is installed, it is to meet the relevant requirements of this Chapter and the requirements of **Chapters 22** to **35**, as appropriate.
3. Fire-extinguishing systems using Halon 1211, 1301 and 2402 and perfluorocarbons are to be prohibited.
4. In general, the use of steam as a fire-extinguishing medium in fixed fire-extinguishing systems is not permitted. Where the use of steam is permitted by the Society, it is to be used only in restricted areas as an addition to the required fire-extinguishing system and is to comply with the requirements of **Chapter 25**.
5. When a pump system is commonly served for fixed water-based fire-extinguishing systems (except those required in **10.6**) for the protection of different areas, appropriate measures are to be taken for a system consisting of fire-extinguishing systems, pump systems, etc., to prevent that a damage or a failure of any one fire-extinguishing system will result in a failure of function of other fire-extinguishing systems.

10.4.2 Closing Appliances for Fixed Gas Fire-extinguishing Systems

Where a fixed gas fire-extinguishing system is used, openings which may admit air to, or allow gas to escape from, a protected space are to be capable of being closed from outside the protected space.

10.4.3 Storage Rooms of Fire-extinguishing Medium

When the fire-extinguishing medium is stored outside a protected space, it is to be in accordance with the following requirements:

(1) It is to be stored in a room which is located behind the forward collision bulkhead.

(2) Such a storage room is used for no other purposes.

(3) Any entrance to such a storage room is to preferably be from the open deck and is to be independent of the protected space.

(4) If the storage space is located below deck, it is to be located no more than one deck below the open deck and is to be directly accessible by a stairway or ladder from the open deck.

(5) Spaces which are located below deck or spaces where access from the open deck is not provided are to be fitted with a mechanical ventilation system designed to take exhaust air from the bottom of the space and are to be sized to provide at least 6 air changes per hour.

(6) Access doors are to open outwards, and bulkheads and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and adjacent enclosed spaces are to be gas tight.

(7) For the purpose of the application of the integrity in **Tables 9.1** to **9.4**, such storage rooms are to be treated as fire control stations.

10.4.4 Water Pumps for Other Fire-extinguishing Systems

Pumps, other than those serving the fire main, required for the provision of water for fire-extinguishing systems required by this chapter, their sources of power and their controls are to be installed outside the space or spaces protected by such systems and are to be so arranged that a fire in the space or spaces protected will not put any such system out of action.

10.5 Fire-extinguishing Arrangements in Machinery Spaces

10.5.1 Machinery Spaces containing Oil-fired Boilers or Oil Fuel Units

1. Fixed fire-extinguishing systems

Machinery spaces of category *A* containing oil-fired boilers or oil fuel units are to be provided with any one of the following fixed fire-extinguishing systems. In each case if the engine and boiler rooms are not entirely separate, or if fuel oil can drain from the boiler room into the engine-room, the combined engine and boiler rooms are to be considered as one compartment.

(1) A fixed gas fire-extinguishing system complying with the provision of **Chapter 25**;
(2) A fixed high-expansion foam fire-extinguishing system complying with the provision of **Chapter 26**; and
(3) A fixed pressure water-spraying fire-extinguishing system complying with the provision of **Chapter 27**.

2. Additional fire-extinguishing arrangements

(1) There is to be in each boiler room or at an entrance outside of the boiler room at least one portable foam applicator unit complying with the provisions of **Chapter 24**.
(2) There are to be at least two portable foam extinguishers or equivalent in each firing space in each boiler room and in each space in which a part of the oil fuel installation is situated. There is to be not less than one approved foam-type extinguisher of at least 135 *l* capacity or equivalent in each boiler room. These extinguishers are to be provided with hoses on reels suitable for reaching any part of the boiler room. In the case of domestic boilers of less than 175 *kW*, an approved foam-type extinguisher of at least 135 *l* capacity is not required.
(3) In each firing space there is to be a receptacle containing at least 0.1 m^3 sand, sawdust impregnated with soda, or other approved dry material, along with a suitable shovel for spreading the material. An approved portable extinguisher may be substituted as an alternative.

10.5.2 Machinery Spaces of Category A Containing Internal Combustion Machinery

1. Fixed fire-extinguishing systems

Machinery spaces of category *A* containing internal combustion machinery are to be provided with one of the fixed fire-extinguishing systems in **10.5.1**.

2. Additional fire-extinguishing arrangements

(1) There is to be at least one portable foam applicator unit complying with the provisions of **Chapter 24**.

(2) There are to be in each such space approved foam-type fire extinguishers, each of at least 45 *l* capacity or equivalent, sufficient in number to enable foam or its equivalent to be directed on to any part of the fuel and lubricating oil pressure systems, gearing and other fire hazards. In addition, there is to be provided a sufficient number of portable foam extinguishers or equivalent which are to be so located that no point in the space is more than 10 *m* walking distance from an extinguisher and that there are at least two such extinguishers in each such space. For smaller spaces of ships the Society may consider relaxing this requirement.

10.5.3 Machinery Spaces containing Steam Turbines or Enclosed Steam Engines

1. Fixed fire-extinguishing systems

In spaces containing steam turbines or enclosed steam engines used either for main propulsion or other purposes having in the aggregate a total output of not less than 375 *kW*, one of the fire-extinguishing systems specified in **10.4.1** is to be provided if such spaces are periodically unattended.

2. Additional fire-extinguishing arrangements

(1) There are to be approved foam fire extinguishers each of at least 45 *l* capacity or equivalent sufficient in number to enable foam or its equivalent to be directed on to any part of the pressure lubrication system, on to any part of the casings enclosing pressure lubricated parts of the turbines, engines or associated gearing, and any other fire hazards. However, such extinguishers are not to be required if protection at least equivalent to that required by this subparagraph is provided in such spaces by a fixed fire-extinguishing system fitted in compliance with **10.4.1**.

(2) There are to be a sufficient number of portable foam extinguishers or equivalent which are to be so located that no point in the space is more than 10 *m* walking distance from an extinguisher and that there are at least two such extinguishers in each such space, except that such extinguishers are not to be required in addition to any provided in compliance with **10.5.1-2(2).**

10.5.4 Other Machinery Spaces

Where a fire hazard exists in any machinery space for which no specific provisions for fire-extinguishing appliances are prescribed in **10.5.1**, **10.5.2** and **10.5.3**, there are to be provided in, or adjacent to, that space such a number of approved portable fire extinguishers or other means of fire extinction as the Society may deem sufficient.

10.5.5 Fixed Local Application Fire-fighting Systems

1. The requirements of the provisions in **-2** to **-4** below are to apply to ships of 2,000 *gross tonnages* and above.

2. Machinery spaces of category *A* above 500 m^3 in volume are to, in addition to the fixed fire-extinguishing system required in **10.5.1-1**, be protected by an approved type of fixed water-based or equivalent local application fire-

fighting system. In the case of periodically unattended machinery spaces, the firefighting system is to have both automatic and manual release capabilities. In the case of continuously manned machinery spaces, the fire-fighting system is only required to have a manual release capability.

3. Fixed local application fire-fighting systems are to protect areas such as the following without the necessity of engine shutdown, personnel evacuation, or sealing of the spaces:

(1) The fire hazard portions of internal combustion machinery used for the ship's main propulsion and power generation;

(2) Boiler fronts;

(3) The fire hazard portions of incinerators; and

(4) Purifiers for heated fuel oil.

4. Activation of any local application system is to give a visual and distinct audible alarm in the protected space, the engine control room and the wheelhouse. The alarm is to indicate the specific system activated. The system alarm requirements are to be in addition to, and not a substitute for, the detection and fire alarm system required elsewhere in this Part.

10.6 Fire-extinguishing Arrangements in Control Stations, Accommodation and Service Spaces

10.6.1 Sprinkler Systems

In ships in which method IIC specified in **9.2.2-1**(2) is adopted, an automatic sprinkler, fire detection and fire alarm system is to be fitted in accordance with the requirements in **7.5.1-(2)**.

10.6.2 Spaces containing Flammable Liquid

1. Paint lockers are to be protected by the fire-extinguishing system specified in (**1**) to (**4**) below. In any case, the system is to be operable from outside the protected space.

(1) A carbon dioxide system, designed to give a minimum volume of free gas equal to 40% of the gross volume of the protected space;

(2) A dry powder system, designed for at least 0.5 kg/m^3;

(3) A water spraying or sprinkler system, designed for 5 l/m^2 per minute (Water spraying systems may be connected to the fire main of the ship.); or

(4) A system providing equivalent protection, as determined by the Society.

2. Flammable liquid lockers other than paint lockers are to be protected by an appropriate fire-extinguishing arrangement approved by the Society.

3. For paint lockers of a deck area of less than 4 m^2, which do not give access to accommodation spaces, a carbon dioxide portable fire extinguisher sized to provide a minimum volume of free gas equal to 40% of the gross volume of the space may be accepted in lieu of a fixed system. A discharge port is to be arranged in the locker to allow the

discharge of the extinguisher without having to enter into the protected space. The required portable fire extinguisher is to be stowed adjacent to the port. Alternatively, a port or hose connection may be provided to facilitate the use of fire main water.

10.6.3 Deep-fat Cooking Equipment

Deep-fat cooking equipment is to be fitted with the following:

(1) An automatic or manual extinguishing system tested to an international standard acceptable to the Society;

(2) A primary and backup thermostat with an alarm to alert the operator in the event of failure of either thermostat;

(3) Arrangements for automatically shutting off the electrical power upon activation of the extinguishing system;

(4) An alarm for indicating operation of the extinguishing system in the galley where the equipment is installed; and

(5) Controls for manual operation of the extinguishing system which are clearly labeled for ready use by the crew.

10.7 Fire-extinguishing Arrangements in Cargo Spaces

10.7.1 Fixed Fire-extinguishing Systems for General Cargo

1. Except for RO-RO and vehicle spaces, cargo spaces of ships of 2,000 *gross tonnage* and upwards are to be protected by a fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of **Chapter 25**, or by a fire-extinguishing system which gives equivalent protection.

2. The Society may exempt from the requirements of **-1** above and **10.7.2** provided that cargo spaces of any ship if constructed and solely intended for the carriage of ore, coal, grain, unseasoned timber, non-combustible cargoes or cargoes which constitute a low fire risk. Such exemptions may be granted only if the ship is fitted with steel hatch covers and effective means of closing all ventilators and other openings leading to the cargo spaces. In this case, a list of cargoes intended to be carried is to be submitted to the Society.

10.7.2 Fixed Fire-extinguishing Systems for Dangerous Goods

A ship engaged in the carriage of dangerous goods in any cargo spaces is to be provided with a fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of **Chapter 25** or with a fire-extinguishing system which gives equivalent protection for the cargoes carried.

10.7.3 Firefighting for Ships Designed to Carry Containers on or above the Weather Deck

1. Ships designed to carry containers on or above the weather deck are to comply with the following (1) and (2):

(1) Ships are to carry, in addition to the equipment and arrangements required by 10.1 and 10.2, at least one water mist lance; and

(2) The water mist lance is to consist of a tube with a piercing nozzle which is capable of penetrating a container wall and producing water mist inside a confined space (container, etc.) when connected to the fire main.

2. Ships designed to carry five or more tiers of containers on or above the weather deck are to comply with, in addition to -1 above, the following (1) to (5):

(1) Ships are to carry the following number of mobile water monitors deemed appropriate by the Society:

(a) Ships with breadth less than 30 m: at least two mobile water monitors; or

(b) Ships with breadth of 30 m or more: at least four mobile water monitors.

(2) The mobile water monitors, all necessary hoses, fittings and required fixing hardware are to be kept ready for use in a location outside the cargo space area not likely to be cut-off in the event of a fire in the cargo spaces.

(3) A sufficient number of fire hydrants are to be provided such that:

(a) All provided mobile water monitors can be operated simultaneously for creating effective water barriers forward and aft of each container bay;

(b) The two jets of water required by **10.2.1-5** can be supplied at the pressure required by **10.2.1-6;** and

(c) Each of the required mobile water monitors can be supplied by separate hydrants at the pressure necessary to reach the top tier of containers on deck.

(4) The mobile water monitors may be supplied by the fire main, provided the capacity of fire pumps and fire main diameter are adequate to simultaneously operate the mobile water monitors and two jets of water from fire hoses at the required pressure values. If carrying dangerous goods, the capacity of fire pumps and fire main diameter are also to comply with the requirements of **19.3.1-5**, as far as applicable to on-deck cargo areas.

(5) The operational performance of each mobile water monitor is to be tested during Classification Survey on board the ship to the satisfaction of the Society. The test is to verify the following (a) and (b):

(a) The mobile water monitor can be securely fixed to the ship structure ensuring safe and effective operation;

(b) The mobile water monitor jet reaches the top tier of containers with all required monitors and water jets from fire hoses operated simultaneously.

10.8 Cargo Tank Protection

10.8.1 Fixed Deck Foam Systems

1. For tankers of 20,000 tonnes deadweight and upwards a fixed deck foam system is to be provided in accordance with the requirements of **Chapter 34**, except that, in lieu of the above, the Society, after having given consideration to the ships arrangement and equipment, may accept other fixed installations if they afford protection equivalent to the above. The requirements for alternative fixed installations are to comply with the requirements in **-2** below.

2. In accordance with **-1** above, where the Society accepts an equivalent fixed installation in lieu of the fixed deck foam system, the installation is to:

(1) be capable of extinguishing spill fires and also preclude ignition of spilled oil not yet ignited; and

(2) be capable of combating fires in ruptured tanks.

3. Tankers of less than 20,000 tonnes deadweight are to be provided with a deck foam system complying with the requirements of **Chapter 34**.

4. The foam concentrate is to be limited to only one type which is effective in fire of any cargoes intended to be carried.

10.9 Protection of Cargo Pump Rooms

10.9.1 Fixed Fire-extinguishing Systems

Each cargo pump-room is to be provided with one of the following fixed fire-extinguishing systems operated from a readily accessible position outside the pump-room. Cargo pump-rooms are to be provided with a system suitable for machinery spaces of category *A*.

(1) A carbon dioxide system complying with the provisions of **Chapter 25** and with the following:

  (a) the alarms giving audible warning of the release of fire-extinguishing medium are to be safe for use in a flammable cargo vapour/air mixture; and

  (b) a notice is to be exhibited at the controls stating that due to the electrostatic ignition hazard, the system is to be used only for fire extinguishing and not for inerting purposes.

(2) A high-expansion foam system complying with the provisions of **Chapter 26**, provided that the foam concentrate supply is suitable for extinguishing fires involving the cargoes carried.

(3) A fixed pressure water-spraying system complying with the provisions of **Chapter 27**.

10.9.2 Quantity of Fire-extinguishing Medium

Where the extinguishing medium used in the cargo pump-room system is also used in systems serving other spaces, the quantity of medium provided or its delivery rate need not be more than the maximum required for the largest compartment.

10.9.3 Portable Fire Extinguishers

Each cargo pump room is to be provided with at least two portable foam extinguishers or equivalent, one at the position the pumps are installed and one at the pump room entrance.

10.10 Fire-fighter s Outfits

10.10.1 Types of Fire-fighter s Outfits

Fire-fighter s outfits are to comply with the requirements of **Chapter 23.**

10.10.2 Number of Fire-fighter s Outfits

1. Ships are to carry at least two fire-fighter s outfits.

2. In addition, in tankers, two fire-fighter s outfits are to be provided.

3. The Society may require additional sets of personal equipment and breathing apparatus, having due regard to the size and type of the ship.

4. Two spare charges are to be provided for each required breathing apparatus. Ships that are equipped with suitably located means for fully recharging the air cylinders free from contamination, need carry only one spare charge for each required apparatus.

10.10.3 Storage of Fire-fighter s Outfits

The fire-fighter s outfits or sets of personal equipment are to be kept ready for use in an easily accessible location that is permanently and clearly marked and, where more than one fire-fighter s outfit or more than one set of personal equipment is carried, they are to be stored in widely separated positions.

Chapter 11 STRUCTURAL INTEGRITY

11.1 General

11.1.1 Purpose

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

11.2 Material

11.2.1 Material of Hull, Superstructures, Structural Bulkheads, Decks and Deckhouses

The hull, superstructures, structural bulkheads, decks and deckhouses are to be constructed of steel or other equivalent material. For the purpose of applying the definition of steel or other equivalent material as given in **3.2.43**, the applicable fire exposure is to be according to the integrity and insulation standards given in **Tables 9.1** to **9.4**. For example, where divisions such as decks or sides and ends of deckhouses are permitted to have "*B*-0" class fire integrity, the applicable fire exposure is to be half an hour.

11.3 Structure

11.3.1 Structure of Aluminium Alloy

Unless otherwise specified in **11.2.1**, in cases where any part of the structure is of aluminium alloy, the following is to apply:

(1) The insulation of aluminium alloy components of "*A*" or "*B*" class divisions, except structure which, in the opinion of the Society, is non-load-bearing, is to be such that the temperature of the structural core does not rise more than 200°*C* above the ambient temperature at any time during the applicable fire exposure to the standard fire test; and

(2) Special attention is to be given to the insulation of aluminium alloy components of columns, stanchions and other structural members required to support lifeboat and liferaft stowage, launching and embarkation areas, and "*A*" or "*B*" class divisions to ensure:

  (a) That for such members supporting lifeboat and liferaft areas and "*A*" class divisions, the temperature rise limitation specified in **(1)** above is to apply at the end of one hour; and

  (b) That for such members required to support "*B*" class divisions, the temperature rise limitation specified in (1) above is to apply at the end of half an hour

11.4 Machinery Spaces of Category A

11.4.1 Crowns and Casings

Crowns and casings of machinery spaces of category *A* are to be of steel construction and are to be insulated as required by **Tables 9.1** to **9.4**, as appropriate.

11.4.2 Floor Plating

The floor plating of normal passageways in machinery spaces of category *A* is to be made of steel or other equivalent material.

11.5 Overboard Fittings

11.5.1 Materials of Overboard Fittings

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

11.6 Protection of Cargo Tank Structure against Pressure or Vacuum

11.6.1 General

The venting arrangements are to be so designed and operated as to ensure that neither pressure nor vacuum in cargo tanks is not to exceed design parameters and be such as to provide for:

(1) The flow of the small volumes of vapour, air or inert gas mixtures caused by thermal variations in a cargo tank in all cases through pressure/vacuum valves of a type approved by the Society in accordance with the procedure deemed appropriate by the Society; and

(2) The passage of large volumes of vapour, air or inert gas mixtures during cargo loading and ballasting, or during discharging.

11.6.2 Openings for Small Flow by Thermal Variations

Openings for pressure release required by **11.6.1**(1) are to:

(1) Have as great a height as is practicable above the cargo tank deck to obtain maximum dispersal of flammable vapours but in no case less than 2 *m* above the cargo tank deck; and

(2) Be arranged at the furthest distance practicable but not less than 5 *m* from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery and equipment which may constitute an ignition hazard. Anchor windlass and chain locker openings constitute an ignition hazard.

11.6.3 Safety Measures in Cargo Tanks

1. Preventive measures against liquid rising in the venting system

Provision is to be made to guard against liquid rising in the venting system to a height which would exceed the design head of cargo tanks. This is to be accomplished by high-level alarms or overflow control systems approved by the Society in accordance with the procedure deemed appropriate by the Society or other equivalent means, together with independent gauging devices required by **14.2.8, Part 7** of the Rules and cargo tank filling procedures. For the purposes of this paragraph, spill valves are not considered equivalent to an overflow system.

2. Secondary means for pressure/vacuum relief

A secondary means of allowing full flow relief of vapour, air or inert gas mixtures are to be provided to prevent over-pressure or under-pressure in the event of failure of the arrangements in **11.6.1(2).** Alternatively, pressure sensors may be fitted in each tank protected by the arrangement required in **11.6.1(2),** with a monitoring system in the ship's cargo control room or the position from which cargo operations are normally carried out. Such monitoring equipment is to also provide an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a tank.

3. Bypasses in vent mains

Pressure/vacuum valves required by **11.6.1(1)** may be provided with a bypass arrangement when they are located in a vent main or masthead riser. Where such an arrangement is provided there are to be suitable indicators to show whether the bypass is open or closed.

4. Pressure/vacuum breaking devices

One or more pressure/vacuum breaking devices are to be provided to prevent the cargo tanks from being subject to (**1**) and (**2**) below. Such devices are to be installed on the inert gas main unless they are installed in the venting system required by **4.5.3-1** or on individual cargo tanks. The location and design of the devices are to be in accordance with **4.5.3** and **11.6.**

(1) A positive pressure in excess of the test pressure of the cargo tank if the cargo were to be loaded at the maximum rated capacity and all other outlets are left shut; and

(2) A negative pressure in excess of 700 *mm* water gauge if cargo was to be discharged at the maximum rated capacity of the cargo pumps and the inert gas blowers were to fail.

11.6.4 Size of Vent Outlets

Vent outlets for cargo loading, discharging and ballasting required by **11.6.1(2)** are to be designed on the basis of the maximum designed loading rate multiplied by a factor of at least 1.25 to take account of gas evolution, in order to prevent the pressure in any cargo tank from exceeding the design pressure. Ships are to be provided with information regarding the maximum permissible loading rate for each cargo tank and in the case of combined venting systems, for each group of cargo tanks.

Chapter 12 NOTIFICATIONS OF CREW AND PASSENGERS

12.1 General

12.1.1 Purpose

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

12.1.2 General Emergency Alarm System

A general emergency alarm system required by *SOLAS*, as may be amended, is to be used for notifying crew and passengers of a fire.

12.1.3 Public Address Systems

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

Chapter 13 MEANS OF ESCAPE

13.1 General

13.1.1 Purpose

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

(1) Safe escape routes are to be provided;

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

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

13.2 General Requirements

13.2.1 Application

Unless expressly provided otherwise in this Chapter, at least two widely separated and ready means of escape are to be provided from all spaces or group of spaces.

13.2.2 Lifts

Lifts are not considered as forming one of the required means of escape as required by this Chapter.

13.3 Means of Escape from Control Stations, Accommodation and Service Spaces

13.3.1 General Requirements

1. Stairways and ladders are to be so arranged as to provide ready means of escape to the lifeboat and liferaft embarkation deck from all passenger and crew accommodation spaces and from spaces in which the crew is normally employed, other than machinery spaces.

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

3. All stairways in accommodation and service spaces and control stations are to be of steel frame construction except where the Society sanctions the use of other equivalent material.

4. If a radiotelegraph station has no direct access to the open deck, two means of escape from or access to, the station are to be provided, one of which may be a porthole or window of sufficient size or other means to the satisfaction of the Society.

5. Doors in escape routes are, in general, to open in-way of the direction of escape, except that:

(1) Individual cabin doors may open into the cabins in order to avoid injury to persons in the corridor when the door is opened; and

(2) Doors in vertical emergency escape trunks may open out of the trunk in order to permit the trunk to be used both for escape and for access.

13.3.2 Details of Means of Escape

1. General

At all levels of accommodation there are to be provided at least two widely separated means of escape from each restricted space or group of spaces.

2. Escape from spaces below the lowest open deck

Below the lowest open deck the main means of escape is to be a stairway and the second escape may be a trunk or a stairway.

3. Escape from spaces above the lowest open deck

Above the lowest open deck the means of escape are to be stairways or doors to an open deck or a combination thereof.

4. Dead-end corridors

No dead-end corridors having a length of more than 7 *m* is to be accepted.

5. Width and continuity of escape routes

The width, number and continuity of escape routes are to be in accordance with the requirements in **Chapter 33.**

6. Dispensation from two means of escape

Exceptionally the Society may dispense with one of the means of escape, for crew spaces that are entered only occasionally, if the required escape route is independent of watertight doors.

13.3.3 Emergency Escape Breathing Devices

1. Emergency escape breathing devices are to comply with the requirements in **Chapter 23**. Spare emergency escape breathing devices are to be kept onboard.

2. All ships are to carry at least two emergency escape breathing devices within accommodation spaces.

3. The number and location of all these devices including spare devices is to be indicated on the fire control plan required by **15.2.2**

13.4 Means of Escape from Machinery Spaces

13.4.1 Escape from Machinery Spaces of Category *A*

Except as provided in **13.4.2**, two means of escape are to be provided from each machinery space of category *A*. In particular, one of the following provisions is to be complied with:

(1) Two sets of steel ladders as widely separated as possible leading to doors in the upper part of the space similarly separated and from which access is provided to the open deck. One of these ladders is to be located within a protected enclosure that satisfies the provisions of **9.2.3-2** or **9.2.4-2**, as applicable, as a space of category **(4)** from the lower part of the space it serves to a safe position outside the space. Self-closing fire doors of the same fire integrity standards are to be fitted in the enclosure (hereinafter, referred to as fire shelter). The ladder is to be fixed in such a way that heat is not transferred into the fire shelter-through non-insulated fixing points. The enclosure is to have minimum internal dimensions of at least 800 *mm* x 800 *mm*, and is to have emergency lighting provisions; or

(2) one steel ladder leading to a door in the upper part of the space from which access is provided to the open deck and additionally, in the lower part of the space and in a position well separated from the ladder referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the open deck.

13.4.2 Dispensation from Two Means of Escape

In a ship of less than 1,000 *gross tonnage*, the Society may dispense with one of the means of escape required by **13.4.1**, due regard being paid to the dimension and disposition of the upper part of the space. In addition, the means of escape from machinery spaces of category *A* need not comply with the requirement for an enclosed fire shelter listed in **13.4.1(1).**

13.4.3 Escape from Machinery Spaces other than Those of Category A

1. From machinery spaces other than those of category *A*, two escape routes are to be provided except that a single escape route may be accepted for spaces that are entered only occasionally, and for spaces where the maximum travel distance to the door is 5 *m* or less.

2. In the steering gear space, a second means of escape is to be provided when the emergency steering position is located in that space unless there is direct access to the open deck.

13.4.4 Inclined Ladders and Stairways

All inclined ladders/stairways fitted to comply with 13.4.1 with open treads in machinery nspaces being part of or providing access to escape routes but not located within a protected n enclosure are to be made of steel. Such ladders/stairways are to be fitted with steel shields attached to their undersides, such as to provide escaping personnel protection against heat and flame from beneath.

13.4.5 Escape from Machinery Control Rooms in Machinery Spaces of Category A

Two means of escape are to be provided from the machinery control room located within a machinery space. At least one of these escape routes are to provide a continuous fire shelter to a safe position outside the machinery space.

13.4.6 Escape from Main Workshops in Machinery Spaces of Category A

Two means of escape are to be provided from the main workshop within a machinery space. At least one of these escape routes are to provide a continuous fire shelter to a safe position outside the machinery space.

13.4.7 Emergency Escape Breathing Devices

1. On all ships, within the machinery spaces, emergency escape breathing devices are to be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of fire. The location of emergency escape breathing devices is to take into account the layout of the machinery space and the number of persons normally working in the spaces.

2. The number and location of these devices is to be indicated in the fire control plan required in **15.2.2.**

3. Emergency escape breathing devices are to comply with the requirements in **Chapter 23**.

13.5 Means of Escape from Ro-Ro Spaces

13.5.1 Arrangement of Means of Escape

At least two means of escape are to be provided in ro-ro spaces where the crew are normally employed. The escape routes are to provide a safe escape to the lifeboat and liferaft embarkation deck and are to be located at the fore and aft ends of the space.

Chapter 14 OPERATIONAL READINESS AND MAINTENANCE

14.1 General

14.1.1 Purpose

The purpose of this Chapter is to maintain and monitor the effectiveness of the fire safety measures the ship is provided with. For this purpose, the following functional requirements are to be met:

(1) Fire protection systems and fire-fighting systems and appliances are to be maintained ready for use; and

(2) Fire protection systems and fire-fighting systems and appliances are to be properly tested and inspected.

14.1.2 General Requirements

At all times while the ship is in service, the requirements of **14.1.1**(1) are to be complied with. A ship is not in service when:

(1) it is in for repairs or lay-up (either at anchor or in port) or in dry-dock; and

(2) it is declared not in service by the owner or the owner s representative.

14.2 Operational Readiness and Maintenance

14.2.1 Operational Readiness

1. The following fire protection systems are to be kept in good order so as to ensure their required performance if a fire occurs:

(1) Structural fire protection including fire resisting divisions, and protection of openings and penetrations in these divisions;

(2) Fire detection and fire alarm systems; and

(3) Means of escape systems and appliances.

2. Fire-fighting systems and appliances are to be kept in good working order and readily available for immediate use. Portable fire extinguishers which have been discharged are to be immediately recharged or replaced with an equivalent unit.

14.2.2 Maintenance, Testing and Inspections

1. Maintenance, testing and inspections are to be carried out based on the Revised Guidelines for the Maintenance and Inspection of Fire Protection Systems and Appliances (*MSC*.1/*Circ*.1432) developed by the *IMO* and in a manner having due regard to ensuring the reliability of fire-fighting systems and appliances

2. The maintenance plan is to be kept on board the ship.

3. The maintenance plan is to include at least the following fire protection systems and fire-fighting systems and appliances, where installed:

(1) Fire mains, fire pumps and hydrants including hoses, nozzles and international shore connections;

(2) Fixed fire detection and fire alarm systems;

(3) Fixed fire-extinguishing systems and other fire extinguishing appliances;

(4) Automatic sprinkler, fire detection and fire alarm systems;

(5) Ventilation systems including fire and smoke dampers, fans and their controls;

(6) Emergency shut down of fuel supply;

(7) Fire doors including their controls;

(8) General emergency alarm systems;

(9) Emergency escape breathing devices;

(10) Portable fire extinguishers including space charges; and

(11) fire-fighter s outfits.

4. The maintenance programme may be computer-based.

14.3 Additional Requirements for Tankers

14.3.1 Maintenance Plan

In addition to the fire protection systems and appliances listed in **14.2.2-3**, tankers are to develop a maintenance plan for:

(1) Inert gas systems;

(2) deck foam systems;

(3) Fire safety arrangements in cargo pump rooms; and

(4) Flammable gas detectors.

Chapter 15 TRAINING MANUAL AND FIRE CONTROL PLAN

15.1 General

15.1.1 Purpose

The purpose of this Chapter is to mitigate the consequences of fire by means of proper instructions for training and drills of persons onboard in correct procedures under emergency conditions. For this purpose, ships are to be provided with the necessary documents to handle fire emergency cases.

15.2 General Requirements

15.2.1 Training Manuals

1. A training manual is to be provided in each crew mess room and recreation room or in each crew cabin.

2. The training manual is to be written in the working language of the ship.

3. The training manual, which may comprise several volumes, is to contain the instructions and information required in **-4** below in easily understood terms and illustrated wherever possible. Any part of such information may be provided in the form of audio-visual aides in lieu of the manual.

4. The training manual is to explain the following in detail:

(1) General fire safety practice and precautions related to dangers of smoking, electrical hazards, flammable liquids and similar common shipboard hazards;

(2) General instructions on fire fighting activities and fire fighting procedures including procedures for notification a fire and use of manually operated call points;

(3) Meanings of the ships alarms;

(4) Operation and use of fire fighting systems and appliances;

(5) Operation and use of fire doors;

(6) Operation and use of fire and smoke dampers; and

(7) Escape systems and appliances.

15.2.2 Fire Control Plans

1. General arrangement plans are to be permanently exhibited for the guidance of the ships officers, showing clearly for each deck the control stations, the various fire sections enclosed by "*A"* class divisions, the sections enclosed by "*B*" class divisions together with particulars of the fire detection and fire alarm systems, the sprinkler installation, the fire-extinguishing appliances, means of access to different compartments, decks, etc., and the ventilating system including particulars of the fan control positions, the position of dampers and identification numbers of the

ventilating fans serving each section. Alternatively, at the discretion of the Society the aforementioned details may be set out in a booklet, a copy of which is to be supplied to each officer, and one copy is to at all times be available on board in an accessible position. Plans and booklets are to be kept up to date, any alterations thereto are to be recorded as soon as practicable. Description in such plans and booklets is to be in the working language or languages of the ship. If the language is neither English nor French, a translation into one of those languages is to be included.

2. A duplicate set of fire control plans or a booklet containing such plans are to be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shore-side fire-fighting personnel.

Chapter 16 OPERATIONS

16.1 General

16.1.1 Purpose

The purpose of this Chapter is to provide information and instructions for proper ship and cargo handling operations in relation to fire safety. For this purpose, the following functional requirements are to be met:

(1) Fire safety operational booklets are to be provided on board; and

(2) Flammable vapour releases from cargo tank venting is to be controlled.

16.2 Fire Safety Operation

16.2.1 Fire Safety Operational Booklets

1. The required fire safety operational booklet is to contain the necessary information and instructions for the safe operation of the ship and cargo handling operations in relation to fire safety. The booklet is to include information concerning the crew s responsibilities for the general fire safety of the ship while loading and discharging cargo and while underway. Necessary fire safety precautions for handling general cargoes are to be explained. For ships carrying dangerous goods and flammable bulk cargoes, the fire safety operational booklet is also to provide reference to the pertinent fire-fighting and emergency cargo handling instructions contained in the International Maritime Solid Bulk Cargoes Code (*IMSBC Code*), *the IGC and IBC Codes IMO* and the International Maritime Dangerous Goods Code *(IMDG Code)*, as appropriate.

2. The fire safety operational booklet is to be provided in each crew mess room and recreation room or in each crew cabin.

3. The fire safety operational booklet is to be written in the working language of the ship.

4. The fire safety operational booklet may be combined with the training manuals required in **15.2.1**.

16.3 Additional Requirements for Tankers

16.3.1 General

The fire safety operational booklet referred to in **16.2** is to include provisions for preventing fire spread to the cargo area due to ignition of flammable vapours and include procedures of cargo tank gas-purging and/or gas-freeing taking into account the provisions in **16.3.2**.

16.3.2 Procedures for Cargo Tank Purging and/or Gas-freeing

1. When the ship is provided with an inert gas system, the cargo tanks are first to be purged in accordance with the provisions of **4.5.6** and **Chapter 35** until the concentration of hydrocarbon vapours in the cargo tanks has been reduced to less than 2% by volume. Thereafter, gas-freeing may take place at the cargo tank deck level.

2. When the ship is not provided with an inert gas system, the operation is to be such that the flammable vapour is discharged initially through:

(1) The vent outlets as specified in **4.5.3-4**;

(2) Outlets at least 2 *m* above the cargo tank deck level with a vertical efflux velocity of at least 30 *m/s* maintained during the gas-freeing operation; or

(3) Outlets at least 2 *m* above the cargo tank deck level with a vertical efflux velocity of at least 20 *m/s* and which are protected by suitable devices to prevent the passage of flame.

3. The above outlets are to be located not less than 10 m measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard.

4. When the flammable vapour concentration at the outlet has been reduced to 30% of the lower flammable limit, gas-freeing may be continued at cargo tank deck level.

16.3.3 Operation of inert gas system

1. The inert gas system for tankers required in accordance with **4.5.5-1** is to be so operated as to render and maintain the atmosphere of the cargo tanks non-flammable, except when such tanks are required to be gas-free.

2. Notwithstanding the **-1** above, for chemical tankers, the application of inert gas, may take place after the cargo tank has been loaded, but before commencement of unloading and are to continue to be applied until that cargo tank has been purged of all flammable vapours before gas-freeing. Only nitrogen is acceptable as inert gas under this provision.

3. For ships constructed after 1 January 2016, if the oxygen content of the inert gas exceeds 5% by volume, immediate action is to be taken the improve the gas quality. Unless the quality of gas improves, all operations in those cargo tanks to which inert gas is being supplied are to be suspended so as to avoid air being drawn into the cargo tanks, the gas regulating valve, if fitted, is to be closed and the off-specification gas is to vented to atmosphere.

4. In the event that the inert gas system is unable to meet the requirement in -1 above and it has been assessed that it is impractical to effect a repair, then cargo discharge and cleaning of those cargo tanks, requiring inerting is to only resumed when suitable emergency procedures have been followed, taking into account guidelines developed by the Society.

Chapter 17 ALTERNATIVE DESIGN AND ARRANGEMENTS

17.1 General

17.1.1 Purpose

The purpose of this Chapter is to provide the methodology for alternative design and arrangements for fire safety.

17.1.2 General

1. Fire safety design and arrangements may deviate from prescriptive requirements set out in **Chapters 4** to **20** except this Chapter; provided that the design and arrangements meet the fire safety objectives and the functional requirements of this Part.

2. When fire safety design or arrangements deviate from the prescriptive requirements of this Part, engineering analysis, evaluation and approval of the alternative design and arrangements are to be carried out in accordance with this Chapter.

17.1.3 Engineering Analysis

The engineering analysis is to be prepared based on the Guidelines on Alternative Design and Arrangements for Fire Safety (*MSC/Circ.*1002, hereinafter referred to as the Alternative Design Guidelines.) developed by the *IMO* and is to include, as a minimum, the following elements:

(1) Determination of the ship type and space(s) concerned;

(2) Identification of prescriptive requirement(s) with which the ship or the space(s) will not comply;

(3) Identification of the fire and explosion hazards of the ship or the space(s) concerned;

- (a) Identification of the possible ignition sources;
- (b) Identification of the fire growth potential of each space concerned;
- (c) Identification of the smoke and toxic effluent generation potential for each space concerned;
- (d) Identification of the potential for the spread of fire, smoke or of toxic effluents from the space(s) concerned to other spaces;

(4) Determination of the required fire safety performance criteria for the ships or the space(s) concerned addressed by the prescriptive requirement(s);

(a) Performance criteria are to be based on the fire safety objectives and on the functional requirements of this chapter;

(b) Performance criteria are to provide a degree of safety level not less than that achieved by using the prescriptive requirements; and

(c) Performance criteria are to be quantifiable and measurable;

(5) Detailed description of the alternative design and arrangements, including the list of the assumptions used in the design and any proposed operational restrictions or conditions; and

(6) Technical justification demonstrating that the alternative design and arrangements meet the required fire safety performance criteria.

17.1.4 Evaluation of the Alternative Design and Arrangements

1. The engineering analysis required in **17.1.2-2** is to be evaluated and approved by the Administration and the Society taking into account the Alternative Design Guidelines.

2. A copy of the documentation, as approved by the Administration and the Society, indicating that the alternative design and arrangements comply with this Chapter is to be carried onboard the ship.

17.1.5 Re-evaluation due to Change of Conditions

If the assumptions and operational restrictions that were stipulated in the alternative design and arrangements are changed, the engineering analysis is to be carried out under the changed condition and is to be approved by the Administration and the Society.

Chapter 18 HELICOPTER FACILITIES

18.1 General

18.1.1 Purpose

The purpose of this Chapter is to provide additional measures in order to address the fire safety objectives of this Part for ships fitted with special facilities for helicopters. For this purpose, the following functional requirements are to be met:

(1) Helicopter deck structure is to be adequate to protect the ship from the fire hazards associated with helicopter operations;

(2) Fire fighting appliances are to be provided to adequately protect the ship from the fire hazards associated with helicopter operations;

(3) Refueling and hangar facilities are to provide the necessary measures to protect the ship from the fire hazards associated with helicopter operations; and

(4) Operation manuals are to be provided.

18.2 Application

18.2.1 Application

In addition to complying with the requirements of **Chapters 4** to **16** as appropriate, ships equipped with helicopter decks are to comply with the requirements of this Chapter.

18.3 Structure

18.3.1 Construction of Steel or Other Equivalent Material

In general, the construction of the helicopter decks is to be of steel or other equivalent materials. If the helicopter landing deck forms the deckhead of a deckhouse or superstructure, it is to be insulated to "*A*-60" class standard.

18.3.2 Construction of Aluminium or Other Low Melting Point Metals

For use of aluminium or other low melting point metal construction that is not made equivalent to steel, the following provisions are to be satisfied:

(1) If the platform is cantilevered over the side of the ship, after each fire on the ship or on the platform, the platform is to undergo a structural analysis to determine its suitability for further use; and

(2) If the platform is located above the ship's deckhouse or similar structure, the following conditions are to be satisfied;

(a) The deckhouse top and bulkheads under the platform are to have no openings;

(b) Windows under the platform are to be provided with steel shutters; and

(c) After each fire on the platform or in close proximity, the platform is to undergo a structural analysis to determine its suitability for further use.

18.4 Escape

18.4.1 Means of Escape

A helicopter landing deck is to be provided with both a main and an emergency means of escape and access for fire fighting and rescue personnel. These are to be located as far apart from each other as is practicable and preferably on opposite sides of the helicopter landing deck.

18.5 Fire-fighting

18.5.1 Fire-fighting Appliances

In close proximity to the helicopter deck, the following fire-fighting appliances are to be provided and stored near the means of access to that helicopter deck:

(1) At least two dry powder extinguishers having a total capacity of not less than 45 *kg*;

(2) Carbon dioxide extinguishers of a total capacity of not less than 18 *kg* or equivalent;

(3) A suitable foam application system specified in (a) or (b) as applicable;

(a) For a helicopter landing deck, a suitable foam application system consisting of monitors or foam making branch pipes capable of delivering foam to all parts of the helicopter landing deck in all weather conditions in which helicopters can operate. The system is to be capable of delivering a discharge rate as required in **Table 18.1** for at least five minutes; or

(b) For a helicopter winching deck, a suitable foam application system capable of delivering foam to a circle of at least 5 *m* in diameter at a rate of not less than 120 *l*/*minute* for at least five minutes.

(4) The principal agent is to be suitable for use with salt water and a type deemed as appropriate by the Society;

(5) At least two nozzles of a dual-purpose type (jet/spray) complying with the provisions of **10.2.3** and hoses sufficient to reach any part of the helicopter deck;

(6) In addition to the requirements of **10.10**, two sets of fire-fighter s outfits complying with the requirements of **Chapter 23**; and

(7) At least the following equipment is to be stored in a manner that provides for immediate use and protection from the elements:

(a) Adjustable wrench;

(b) Blanket, fire resistant;

(c) Cutters, bolt 60 *cm*;

(d) Hook, grab or salving;

(e) Hacksaw, heavy duty complete with 6 spare blades;

(f) Ladder;

(g) Lift line 5 mm diameter x 15 *m* in length;

(h) Pliers, side cutting;

(i) Set of assorted screwdrivers; and

(j) Harness knife complete with sheath.

Table 18.1 Foam Discharge Rates

Category	Helicopter overall length	Discharge rate of foam solution
H1	up to but not including 15 *m*	250
H2	from 15 *m* up to but not including 24 *m*	500
H3	from 24 *m* up to but not including 35 m	800

18.6 Drainage Facilities

18.6.1 Drainage Facilities

Drainage facilities in way of helicopter landing decks are to be constructed of steel and are to lead directly overboard independent of any other system (except those from weather decks to outboard directly) and are to be designed so that drainage does not fall onto any part of the ship.

18.7 Helicopter Refueling and Hanger Facilities

18.7.1 Safety Measures for Refueling and Hanger Facilities

Where the ship has helicopter refuelling and hangar facilities, the following requirements are to be complied with:

(1) A designated area is to be provided for the storage of fuel tanks which are to be:

(a) As remote as is practicable from accommodation spaces, escape routes and embarkation stations; and

(b) isolated from areas containing an ignition source of flammable vapour;

(2) The fuel storage area is to be provided with arrangements whereby fuel spillage may be collected and drained to a safe location;

(3) Tanks and associated equipment are to be protected against physical damage and from a fire in an adjacent space or area;

(4) Where portable fuel storage tanks are used, special attention is to be given to:

(a) Design of the tank for its intended purpose;

(b) Mounting and securing arrangements;

(c) Electric bonding; and

(d) Inspection procedures;

(5) Storage tank fuel pumps are to be provided with means which permit shutdown from a safe remote location in the event of a fire. Where a gravity fed fuelling system is installed, equivalent closing arrangements is to be provided to isolate the fuel source;

(6) The fuel pumping unit is to be connected to one tank at a time. The piping between the tank and the pumping unit is to be of steel or equivalent material, as short as possible, and protected against damage;

(7) Electrical fuel pumping units and associated control equipment are to be of a type suitable for the location and potential hazards;

(8) Fuel pumping units are to incorporate a device which will prevent over-pressurization of the delivery or filling hose;

(9) All equipment used in refuelling operations is to be electrically bonded;

(10) NO SMOKING signs are to be displayed at appropriate locations;

(11) Hangar, refuelling and maintenance facilities are to be treated as machinery spaces of category *A* with regard to structural fire protection, fixed fire-extinguishing and detection system requirements;

(12) Enclosed hangar facilities or enclosed spaces containing refuelling installations are to be provided with mechanical ventilation as required for enclosed ro-ro spaces in **20.3.1**. Ventilation fans are to be of non-sparking type; and

(13) Electric equipment and wiring in enclosed hanger or enclosed spaces containing refuelling installations are to comply with **20.3.2**, **20.3.3**, **20.3.4** and **20.3.5**.

18.8 Operations Manual

18.8.1 Operations Manual

Each helicopter facility is to have an operations manual, including a description and a checklist of safety precautions, procedures, and equipment requirements. This manual may be part of the ships emergency response procedures.

Chapter 19 CARRIAGE OF DANGEROUS GOODS

19.1 General

19.1.1 Purpose

The purpose of this Chapter is to provide additional safety measures in order to address the fire safety objectives of this Part for ships carrying dangerous goods. For this purpose, the following functional requirements are to be met:

(1) Fire protection systems are to be provided to protect the ship from the added fire hazards associated with carriage of dangerous goods;

(2) Dangerous goods are to be adequately separated from ignition sources; and

(3) Appropriate personnel protective equipment is to be provided for the hazards associated with the carriage of dangerous goods.

19.2 General Requirements

19.2.1 Application

1. In addition to complying with the requirements of regulations in **Chapters 4 to 16, 18** and **20** as appropriate, cargo spaces referred to in **19.2.2**, intended for the carriage of dangerous goods are to comply with the requirements of this Chapter, as appropriate, except when carrying dangerous goods in limited quantities unless such requirements have already been met by compliance with the requirements elsewhere in this Part.

2. Facilities and conditions for carriage which are needed for carrying the dangerous goods specified in **19.2.3**, are to be in accordance with the relevant requirements of the *IMSBC* Code, as defined in Chapter VI, Regulation 1.1 of *SOLAS* (hereinafter referred to as *IMSBC* Code) and the relevant requirements of the *IMDG* Code, as defined in Chapter VII, Regulation 1.1 of the *SOLAS* (hereinafter referred to as *IMDG* Code).

19.2.2 Application for Categories of Cargo Spaces

The following cargo spaces are to govern the application of **Tables 19.1** and **19.2**:

(1) Weather deck cargo spaces;

(2) Cargo spaces not specifically designed: cargo spaces not specially designed for the carriage of freight containers, but intended for the carriage of dangerous goods in packaged form including goods in freight containers and portable tanks;

(3) Container cargo spaces: cargo spaces intended for the carriage of dangerous goods in freight containers and portable tanks;

(4) Closed ro-ro spaces: closed ro-ro spaces, defined in **3.2.12**, intended for the carriage of dangerous goods;

(5) Open ro-ro spaces: open ro-ro spaces, defined in **3.2.35,** intended for the carriage of dangerous goods;

(6) Shipborne barge cargo spaces: cargo spaces intended for carriage of dangerous goods other than liquids and gases in bulk in shipborne barges; and

(7) Bulk cargo spaces: cargo spaces intended for the carriage of solid dangerous goods in bulk.

19.2.3 Classes of Dangerous Goods

Dangerous Goods, to which the requirements in this Chapter are applied, are classified into 23 classes as follows:

(1) Explosives in Class **1.1** to **1.6** as defined in the *IMDG Code* except goods in division 1.4, compatibility group S (hereinafter, referred to as goods in Class 1.4*S*).

(2) Explosives in Class 1.4S as defined in the *IMDG Code*.

(3) Flammable high-pressure gases in Class 2.1 as defined in the *IMDG Code*.

(4) Non-flammable non-poisonous (non-toxic) high-pressure gases in Class 2.2 as defined in the *IMDG Code.*

(5) Flammable poisonous (toxic) high-pressure gases in Class 2.3 as defined in the *IMDG Code*.

(6) Non-flammable poisonous (toxic) high-pressure gases in Class 2.3 as defined in the IMDG *Code*.

(7) Flammable liquid having a flashpoint of 23ºC and in Class 3 as defined in the *IMDG Code.*

(8) Flammable liquid substances having a flashpoint of 23° or above and less or equal to 60°C and in Class 3 as defined in the *IMDG Code*

(9) Flammable solid substances in Class 4 as defined in the *IMDG Code*

(10) Substances liable to spontaneous combustion in Class 4.2 as defined in the *IMDG Code*.

(11) Substances which, in contact with water, emit flammable gases in Class 4.3 as defined in the *IMDG Code.*

(12) Solid substances which, in contact with water, emit flammable gases in Class 4.3 as defined in the *IMDG Code*.

(13) Oxidizing substances in Class 5.1 as defined in *the IMDG Code*.

(14) Organic peroxides in Class 5.2 as defined in *IMDG Code*.

(15) Poisonous (toxic) substances having a flashpoint of less than 23ºC and in Class 6.1 as defined in the *IMDG Code.*

(16) Poisonous (toxic) substances having a flashpoint of 23ºC or above and less than or equal to 60º*C* and in Class 6.1 as defined in the *IMDG Code*

(17) Poisonous (toxic) liquid substances having a flashpoint of greater than 60°C and in Class 6.1 as defined in the *IMDG Code.*

(18) Poisonous (toxic) substances in Class 6.1 as defined in the *IMDG Code.*

(19) Corrosives liquid substances having a flashpoint of less than 23°*C* and in Class 8 as defined in the *IMDG Code*.

(20) Corrosives liquid substances having a flashpoint of 23º*C* or above and less than or equal to 60°*C* and in Class 8 as defined in the *IMDG Code.*

(21) Corrosives liquid substances having a flashpoint of greater than 60°C and in Class 8 as defined in *IMDG Code*.

(22) Solid corrosives in Class 8 as defined in the *IMDG Code*.

(23) Miscellaneous dangerous substances in Class 9 as defined in the *IMDG Code*.

19.2.4 Application of Special Requirements

Unless otherwise specified, the following requirements are to govern the application of Tables **19.1**, **19.2** and **19.3** to both on-deck and under-deck stowage of dangerous goods where the numbers of the following requirements are indicated in the first column of the tables.

Table 19.1 Application of the Requirements to Different Modes of Carriage of Dangerous Goods in Ships

Special Requirements (**19.3**)	Categories of Cargo Spaces (19.2.2)					
	(1)	(2)	(3)	(4)	(5)	(6)
19.3.1-1 Remote arrangements for fire pumps	X	X	X	X	X	X
19.3.1-2 Quantity of water delivery	X	X	X	X	X	-
19.3.1-3 Cooling arrangements (water spraying or flooding)	-	X	X	X	X	X
19.3.1-4 Cooling arrangements (using media other than water)	-	X	X	X	X	X
19.3.1-5 Total capacity of water supply	X	X	X	X	X	-
19.3.2 Sources of ignition	-	X	X	X	X	X[d]
19.3.3 Detection system	-	X	X	X	-	X[d]
19.3.4-1 Power ventilation	-	X	X[a]	X	-	X[d]
19.3.4-2 Ventilation fans (ignition-free)	-	X	X[a]	X	-	X[d]
19.3.5 Bilge pumping	-	X	X	X	-	-
19.3.6-1 Personnel protection	X	X	X	X	X	-
19.3.6-2 Self-contained breathing apparatus	X	X	X	X	X	-
19.3.7 Portable fire extinguishers	X	X	-	-	X	-
19.3.8 Insulation of machinery space boundaries	X	X	X[b]	X	X	-
19.3.9 Water spray system	-	-	-	X[c]	X	-
19.3.10-1 Separation of ro-ro spaces	-	-	-	X	-	-
19.3.10-2 Separation of weather decks	-	-	-	X	-	-

Notes:

1 The categories of cargo spaces in **Table 19.1** in accordance with the provisions of **19.2.2** are as follows.

(1) Weather deck cargo spaces (including **(2)** to **(6)** below)

(2) Cargo spaces not specially designed

(3) Container cargo spaces

(4) Closed ro-ro spaces

(5) Open ro-ro spaces

(6) shipborne barge cargo spaces

2 Where "X" appears in **Table 19.1**, it means that such requirements are to be applied to all categories of dangerous goods as given in the corresponding line of **Table 19.3**, except as indicated in the notes below.

3 Subscripts in **Table 19.1** are as follows.

a: For *Classes* 4 and 5.1 solids (**19.2.3 (9)**, (**10**), (**12**) and (**13**)) not applicable to freight containers
For *Classes* 2, 3, 6.1 and 8 (**19.2.3(3)** to (**8**) and (**15**) to (**22**) when carried in closed freight containers the ventilation rate may be reduced to not less than two air changes. For Classes 4 and 5.1 liquids (**19.2.3(9)** to (**11**) and (**13**)) when carried in close freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For the purpose of this requirement a portable tank is a closed freight container.

b: Applicable to decks only.

c: Applies only to closed ro-ro spaces, not capable of being sealed.

d: In the special case where the barges are capable of containing flammable vapours or alternatively if they are capable of discharging flammable vapours to a safe space outside the barge carrier compartment by means of ventilation ducts connected to the barges, these requirements may be reduced or waived to the satisfaction of the Society.

Table 19.2 Application of the Requirements to Different Classes of Dangerous Goods for Carrying Solid Dangerous Goods in Bulk

Special Requirements (**19.3**)	Classification of Dangerous Goods (**19.2.3**)						
	4.1	4.2	4.3[a]	5.1	6.1	8	9
19.3.1-1 Remote arrangements for fire pumps	X	X	-	X	-	-	X
19.3.1-2 Quantity of water delivery	X	X	-	X	-	-	X
19.3.1-5 Total capacity of water supply	X	X	-	X	-	-	X
19.3.2 Sources of ignition	X	X[b]	X	X[c]	-	-	X[c]
19.3.4-1 Power ventilation	-	X[b]	X	-	-	-	-
19.3.4-2 Ventilation fans (ignition-free)	X[d]	X[b]	X	X [b,d]	-	-	X [b,d]
19.3.4-3 Natural ventilation	X	X	X	X	X	X	X
19.3.6 Personnel protection	X	X	X	X	X	X	X
19.3.8 Insulation of machinery space boundaries	X	X	X	X[b]	-	-	X[e]

Notes:

1 Classes of dangerous goods in **Table 19.2** in accordance with the provisions of **19.2.3** are as follows.

4.1: Flammable solids in *Class* 4.1 (**19.2.3(9)**)

4.2: Substances liable to spontaneous combustion in Class 4.2 (**19.2.3(10)**)

4.3: Substances which, in contact with water, emit flammable gases in Class 4.3 (**19.2.3(11)** and (**12**))

5.1: Oxidizing substances in *Class* 5.1 (**19.2.3(13)**)

6.1: Solid poisonous (toxic) substances in Class 6.1 (**19.2.3(18)**)

8: Solid corrosives in *Class* 8 (**19.2.3(22))**

9: Miscellaneous dangerous substances in Class 9 (**19.2.3(23**))

2 Whenever "X" appears in **Table 19.2**, it means that this special requirement for the dangerous goods is applicable.

3 Subscripts in **Table 19.2** are as follows.

a: The hazards of substances in this class which may be carried in bulk are such that special consideration must be given by the Society to the construction and equipment of the ship involved in addition to meeting the requirements enumerated in this table.

b: Only applicable to Seedcake containing solvent extractions, to Ammonium nitrate and Ammonium nitrate fertilizers.

c: Only applicable to Ammonium nitrate and Ammonium nitrate fertilizers. However, a degree of protection in accordance with standards contained in the International Electrotechnical Commission, publication 60079, Electrical Apparatus for Explosive Gas Atmospheres, is sufficient.

d: Only suitable wire mesh guards are required.

e: The requirements of *IMSBC* Code are sufficient.

Table 19.3 Application of the Requirements to Different Classes of Dangerous Goods except Solid Dangerous Goods in Bulk

Special requirements (**19.3**)	Classification of Dangerous Goods (19.2.3)																						
	1	1.4*S*	2.1	2.2	2.3 *F*[i]	2.3 *NF*	3L	3M	4.1	4.2	4.3 liquids[j]	4.3	5.1	5.2[e]	6.1L liquids	6.1M liquids	6.1H liquids	6.1	8L liquids	8 M liquids	8H liquids	8	9
19.3.1-1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
19.3.1-2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
19.3.1-3	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19.3.1-4	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-
19.3.1-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
19.3.2	X	-	X	-	X	-	X	-	-	-	X[g]	-	-	-	X	-	-	-	X	-	-	-	X[f]
19.3.3	X	X	X	X	-	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	X	X	-
19.3.4-1	-	-	X	-	-	X	X	-	X[a]	X[a]	X	X	X[a]	-	X	X	-	X[a]	X	X	-	-	X[a]
19.3.4-2	-	-	X	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X[f]
19.3.5	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	X	X	-	X	X[h]	X[h]	-	-
19.3.6	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[d]
19.3.7	-	-	-	-	-	-	X	X	X	X	X	X	X	-	X	X	-	-	X	X	X	-	-
19.3.8	X[b]	-	X	X	X	X	X	X	X	X	X	X	X[c]	X	X	X	-	-	X	X	X	-	-
19.3.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
19.3.10-1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
19.3.10-2	X	X	X	X	X	X	X	X	X-	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:

1 Classes of dangerous goods in **Table 19.3** in accordance with the provisions of **19.2.3** are as follows.

1 : Explosives in *Class* 1.1 to 1.6 except *Class* 1.4*S* **(19.2.3(1))**

1.4S : Explosives in *Class* 1.4S (**19.2.3(2))**

2.1 : Flammable high-pressure gases in *Class* 2.1 (**19.2.3(3**))

2.2 : Non-flammable non-poisonous (non-toxic) high-pressure gases in *Class* 2.2 (**19.2.3(4**))

2.3*F* : Poisonous (toxic) high-pressure gases in *Class* 2.3 (**19.2.3(5**))

3*L* : Flammable liquid having a flashpoint of less than 23ºC in *Class* 3 (**19.2.3(6))**

3*M* : Flammable liquid having a flashpoint of 23ºC or above and less than or equal to 61ºC in *Class* 3 (**19.2.3(7))**

4.1 : Flammable solids in *Class* 4.1 **(19.2.3(9**))

4.2 : Substances liable to spontaneous combustion in *Class* 4.2 (**19.2.3(10))**

4.3 liquids : Liquid substances which, in contact with water, emit flammable gases in *Class* 4.3 **(19.2.3(11**))

4.3 : Solid substances which, in contact with water, emit flammable gases in *Class* 4.3 **(19.2.3(12**))

5.1 : Oxidizing substances in *Class* 5.1 (**19.2.3(13)**)

5.2 : Organic peroxides in *Class* 5.2 (**19.2.3(14)**)

6.1*L* liquids : Poisonous (toxic) substances having a flashpoint of less than 23ºC in *Class* 6.1 Code. (**19.2.3(15)**)

6.1*M* liquids : Poisonous (toxic) substances having a flashpoint of 23ºC or above and less than or equal to 60ºC in *Class* 6.1 (**19.2.3(16)**)

6.1*H* liquids : Poisonous (toxic) substances having a flashpoint of greater than 60ºC in *Class* 6.1 (**19.2.3(17**))

6.1 : Solid poisonous (toxic) substances in *Class* 6.1 (**19.2.3(18)**)

8*L* liquids : Corrosives having a flashpoint of less than 23ºC in *Class* 8 **(**19.2.3(19))

8*M* liquids : Corrosives having a flashpoint of 23ºC or above and less than or equal to 60ºC in *Class* 8 (**19.2.3(20**))

8*H* liquids : Corrosives having a flashpoint of greater than 60ºC in *Class* 8 **(**19.2.3(21))

8 : Solid corrosives in *Class* 8 (**19.2.3(22)**)

9 : Miscellaneous dangerous substances in *Class* 9 (**19.2.3(23**))

2 Whenever "X" appears in **Table 19.2**, it means that this special requirement for the dangerous goods is applicable.

3 Subscripts in **Table 19.3** are as follows.

a: When "mechanically - ventilated spaces" are required by *IMDG* Code.

b: Stow 3 *m* horizontally away from the machinery space boundaries in all cases.

c: Refer to *IMDG* Code.

d: As appropriate to the goods to be carried.

e: Under the provisions of the *IMDG* Code, as amended, storage of *Class* 5.2 dangerous goods below deck or in enclosed ro-ro spaces is prohibited.

f : Only applicable to dangerous goods evolving flammable vapour listed in the *IMDG* Code.

g : Only applicable to dangerous goods having a flashpoint less than 23ºC listed in the *IMDG* Code.

h : Only applicable to dangerous goods having a subsidiary risk *Class* 6.1.

i : Under the provisions of the *IMDG* Code, stowage of *Class* 2.3 having subsidiary risk *Class* 2.1 under deck or in enclosed ro-ro space is prohibited.

j : Under the provisions of the *IMDG* Code, storage of *Class* 4.3 liquids having a flashpoint less than 23ºC under deck or in enclosed ro-ro spaces is prohibited.

19.3 Special Requirements

19.3.1 Water Supplies

1. Arrangements are to be made to ensure immediate availability of a supply of water from the fire main at the required pressure either by permanent pressurization or by suitably placed remote arrangements for the fire pumps.

2. The quantity of water delivered is to be capable of supplying four nozzles of a size and at pressures as specified in **10.2**, capable of being trained on any part of the cargo space when empty. This amount of water may be applied by equivalent means to the satisfaction of the Society.

3. Means are to be provided for effectively cooling the designated underdeck cargo space by at least 5 l/m^2 per minute of the horizontal area of cargo spaces, either by a fixed arrangement of spraying nozzles or flooding the cargo space with water. Hoses may be used for this purpose in small cargo spaces and in small areas of larger cargo spaces at the discretion of the Society. However, the drainage and pumping arrangements are to be such as to prevent the build-up of free surfaces. The drainage system is to be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The drainage system valves are to be operable from outside the protected space at a position in the vicinity of the extinguishing system controls.

Bilge wells are to be of sufficient holding capacity and are to be arranged at the side shell of the ship at a distance from each other of not more than 40 *m* in each watertight compartment. If this is not possible, suitable measures as deemed appropriate by the Society are to be taken to limit the adverse effect upon stability of the added weight and free surface of water in its approval of the stability information.

4. Provision to flood a designated under-deck cargo space with suitable specified media may be substituted for the requirements in **-3** above.

5. The total required capacity of the water supply is to satisfy the provisions of **-2** and -3 above, if applicable, simultaneously calculated for the largest designated cargo space. The capacity requirements of **-2** above are to be met by the total capacity of the main fire pump(s) not including the capacity of the emergency fire pump, if fitted. If a drencher system is used to satisfy the provisions of **-3** above, the drencher pump is also to be taken into account in this total capacity calculation.

19.3.2 Sources of Ignition

Electrical equipment and wiring is not to be fitted in enclosed cargo spaces or vehicle spaces unless it is essential for operational purposes in the opinion of the Society. However, if electrical equipment is fitted in such spaces, it is to be of a certified safe type for use in the dangerous environments to which it may be exposed unless it is possible to completely isolate the electrical system (e.g. by removal of links in the system, other than fuses). Cable penetrations of the decks and bulkheads are to be sealed against the passage of gas or vapour. Through runs of cables and cables within the cargo spaces are to be protected against damage from impact. Any other equipment which may constitute a source of ignition of flammable vapour is not to be permitted.

19.3.3 Detection System

Ro-Ro spaces are to be fitted with a fixed fire detection and fire alarm system complying with the requirements of **Chapter 29**. All other types of cargo spaces are to be fitted with either a fixed fire detection and fire alarm system or a sample extraction smoke detection system complying with the requirements of **Chapters 29** or **30**, respectively.

If a sample extraction smoke detection system is fitted, particular attention is to be made to the provisions of **30.2.1-3** in order to prevent the leakage of toxic fumes into occupied areas.

19.3.4 Ventilation

1. Adequate power ventilation is to be provided in enclosed cargo spaces. The arrangement is to be such as to provide for at least six air changes per hour in the cargo space based on an empty cargo space and for removal of vapours from the upper or lower parts of the cargo space, as appropriate.

2. The fans are to be such as to avoid the possibility of ignition of flammable gas air mixtures. Suitable wire mesh guards are to be fitted over inlet and outlet ventilation openings.

3. Natural ventilation is to be provided in enclosed cargo spaces intended for the carriage of solid dangerous goods in bulk, where there is no provision for mechanical ventilation.

19.3.5 Bilge Pumping

1. Where it is intended to carry flammable or toxic liquids in enclosed cargo spaces, the bilge pumping system is to be designed to ensure against inadvertent pumping of such liquids through machinery space piping or pumps. Where large quantities of such liquids are carried, consideration is to be given to the provision of additional means of draining those cargo spaces.

2. If the bilge drainage system is additional to the system served by pumps in the machinery space, the capacity of the system is to be not less than 10 m^3/h per cargo space served. If the additional system is common, the capacity need not exceed 25 m^3/h. The additional bilge system need not be arranged with redundancy.

3. Whenever flammable or toxic liquids are carried, the bilge line into the machinery space is to be isolated either by a stop valve and a blank flange or by a closed lockable valve fitted in the machinery space.

4. Cargo spaces intended for carriage of flammable or toxic liquids and enclosed spaces outside machinery spaces containing bilge pumps serving such cargo spaces are to be fitted with separate mechanical ventilation of exhaust type giving at least 6 *air changes per hour*. If the space has access from another enclosed space, the door is to be of reasonably gas-tight and self-closing.

5. If bilge drainage of cargo spaces is arranged by gravity drainage, the drainage is to be either lead directly overboard or to a closed drain tank located outside the machinery spaces. The tank is to be provided with a vent pipe to a safe location on the open deck. Drainage from a cargo space into bilge wells in a lower space is only permitted if that space satisfies the same requirements as the cargo space above.

19.3.6 Personnel Protection

1. Four sets of full protective clothing resistant to chemical attack are to be provided in addition to the fire-fighter s outfits required by the provisions of **10.10**. The protective clothing is to cover all skin, so that no part of the body is unprotected.

2. At least two self-contained breathing apparatuses additional to those required by **Chapter 10** are to be provided. Two spare charges suitable for use with the breathing apparatus are to be provided for each required apparatus. Ships that are equipped with suitably located means for fully recharging the air cylinders free from contamination, need carry only one spare charge for each required apparatus.

19.3.7 Portable Fire Extinguishers

Portable fire extinguishers with a total capacity of at least 12 *kg* of dry powder or equivalent are to be provided for the cargo spaces. These extinguishers are to be in addition to any portable fire extinguishers required elsewhere in this Part.

19.3.8 Insulation of Machinery Space Boundaries

Bulkheads forming boundaries between cargo spaces and machinery spaces of category A are to be insulated to "*A*-60" class standard, unless the dangerous goods are stowed at least 3 *m* horizontally away from such bulkheads. Other boundaries between such spaces are to be insulated to "*A*-60" class standard.

19.3.9 Water Spray System

Each open ro-ro space having a deck above it and each space deemed to be a closed ro-ro space not capable of being sealed is to be fitted with an approved fixed pressure water-spraying system for manual operation which is to protect all parts of any deck and vehicle platform in such space, except that the Society may permit the use of any other fixed fire-extinguishing system that has been shown by full-scale test to be no less effective. In any event, the drainage and pumping arrangements are to be such as to prevent the build-up of free surfaces. The drainage system is to be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The drainage system valves are to be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells are to be of sufficient holding capacity and are to be arranged at the side shell of the ship at a distance from each other of not more than 40 m in each watertight compartment. If this is not possible, suitable measures as deemed appropriate by the Society are to be taken to limit the adverse effect upon stability of the added weight and free surface of water in its approval of the stability information.

19.3.10 Separation of Ro-Ro Spaces

1. In ships having ro-ro spaces, a separation is to be provided between a closed ro-ro space and an adjacent open ro-ro space. The separation is to be such as to minimize the passage of dangerous vapours and liquids between such

spaces. Alternatively, such separation need not be provided if the ro-ro space is considered to be a closed cargo space over its entire length and is to fully comply with the relevant special requirements of this Chapter.

2. In ships having ro-ro spaces, a separation is to be provided between a closed ro-ro space and the adjacent weather deck. The separation is to be such as to minimize the passage of dangerous vapours and liquids between such spaces. Alternatively, a separation need not be provided if the arrangements of the closed ro-ro spaces are in accordance with those required for the dangerous goods carried on adjacent weather deck.

Chapter 20 PROTECTION OF VEHICLE AND RO-RO SPACES

20.1 General

20.1.1 Purpose

The purpose of this Chapter is to provide additional safety measures in order to address the fire safety objectives of this Part for ships fitted with vehicle and ro-ro spaces. For this purpose, the following functional requirements are to be met:

(1) Fire protection systems are to be provided to adequately protect the ship from the fire hazards associated with vehicle and ro-ro spaces;

(2) Ignition sources are to be separated from vehicle and ro-ro spaces; and

(3) Vehicle and ro-ro spaces are to be adequately ventilated.

20.2 General Requirements

20.2.1 Application

In addition to complying with the requirements of **Chapters 4** to **16**, as appropriate, vehicle and ro-ro spaces are to comply with the requirements of this Chapter.

20.3 Precaution against Ignition of Flammable Vapours in Closed Vehicle Spaces and Closed Ro-Ro Spaces

20.3.1 Ventilation Systems

1. Capacity of ventilation systems

There is to be provided an effective power ventilation system sufficient to give at least 6 *air changes per hour* basing upon an empty spaces. The Society may require an increased number of air changes when vehicles are being loaded and unloaded.

2. Performance of ventilation systems

(1) Ventilation fans are normally to be run continuously whenever vehicles are on board. Where this is impracticable, they are to be operated for a limited period daily as weather permits and in any case for a reasonable period prior to discharge, after which period the ro-ro or vehicle space is to be proved gas-free. One or more portable combustible gas detecting instruments deemed as appropriate by the Society are to be carried for this purpose. The system is to be entirely separate from other ventilating systems. Ventilation ducts serving ro-ro or vehicle spaces are to be capable of being effectively sealed for each cargo space. The system is to be capable of being controlled from a position outside such spaces.

(2) The ventilation system is to be such as to prevent air stratification and the formation of air pockets.

3. Indication of ventilation systems

Means are to be provided on the navigation bridge to indicate any loss of the required ventilating capacity.

4. Closing appliances and ducts

(1) Arrangements are to be provided to permit a rapid shutdown and effective closure of the ventilation system from outside of the space in case of fire, taking into account the weather and sea conditions.

(2) Ventilation ducts, including dampers to be made of steel. Ventilation ducts that pass through machinery spaces are to be "*A*-60" class steel ducts constructed in accordance with (**1**) and (**2**) of **9.7.2-4.**

5. Permanent openings

Permanent openings in the side plating, the ends or deckhead of the space are to be so situated that a fire in the cargo space does not endanger stowage areas and embarkation stations for survival craft and accommodation spaces, service spaces and control stations in superstructures and deckhouses above the cargo spaces.

20.3.2 Electrical Equipment and Wiring

1. Except as provided in **-2** above, electrical equipment and wiring installed in vehicle spaces are to be of a type suitable for use in an explosive petrol and air mixture.

2. Notwithstanding the provisions in **-1** above, above a height of 450 *mm* from the deck and from each platform for vehicle, if fitted, except platforms with openings of sufficient size permitting penetration of petrol gases downwards, electrical equipment of a type so enclosed and protected as to prevent the escape of sparks is to be permitted as an alternative on condition that the ventilation system is so designed and operated as to provide continuous ventilation of the cargo spaces at the rate of at least ten air changes per hour whenever vehicles are on board.

20.3.3 Electrical Equipment and Wiring in Exhaust Ventilation Ducts

Electrical equipment and wiring, if installed in an exhaust ventilation duct for vehicle spaces, are to be of a type approved for use in explosive petrol and air mixtures and the outlet from any exhaust duct is to be sited in a safe position, having regard to other possible sources of ignition.

20.3.4 Other Ignition Sources

1. Other equipment which may constitute a source of ignition of flammable vapours in vehicle spaces is not to be permitted.

2. Notices of "No Smoking" are to be posted in way of all access to vehicle and ro-ro spaces.

20.3.5 Scuppers and Discharges

Scuppers for vehicle spaces are not to be led to machinery or other spaces where sources of ignition may be present.

20.4 Detection and Alarm

20.4.1 Fixed Fire Detection and Fire Alarm Systems

There is to be provided a fixed fire detection and fire alarm system complying with the requirements of **Chapter 29**. The fixed fire detection system is to be capable of rapidly detecting the onset of fire. The type of detectors and their spacing and location are to be determined taking into account the effects of ventilation and other relevant factors. After being installed the system is to be tested under normal ventilation conditions and is to give an overall response time to the satisfaction of the Society.

20.4.2 Sample Extraction Smoke Detection Systems

Except open ro-ro spaces and open vehicle spaces, a sample extraction smoke detection system complying with the requirements of **Chapter 30** may be used as an alternative of the fixed fire detection and fire alarm system required in **20.4.1**.

20.5 Fire-extinction

20.5.1 Fixed Fire-extinguishing Systems

1. Vehicle spaces and ro-ro spaces which are capable of being sealed from a location outside of the cargo spaces are to be fitted with a fixed gas fire-extinguishing system which is to comply with the provisions of **Chapter 25**, except that:

(1) If a carbon dioxide system is fitted, the quantity of gas available is to be at least sufficient to give a minimum volume of free gas equal to 45% of the gross volume of the largest such cargo space which is capable of being sealed, and the arrangements are to be such as to ensure that at least two thirds of the gas required for the relevant space is to be introduced within 10 *minutes*;

(2) Any other fixed inert gas fire-extinguishing system or fixed high expansion foam fire-extinguishing system may be fitted provided the Society is satisfied that a protection equivalent to the system specified in **(1)** above is achieved; and

(3) As an alternative, a system meeting the requirements of **-2** below may be fitted.

2. Ro-Ro and vehicle spaces not capable of being sealed and special category spaces are to be fitted with approved fixed pressure water spraying, for manual operation which is to protect all parts of any deck and vehicle platform in such spaces. Such water spray systems are to have:

(1) A pressure gauge on the valve manifold;

(2) Clear marking on each manifold valve indicating the spaces served;

(3) Instructions for maintenance and operation located in the valve room; and

(4) A sufficient number of drainage valves.

3. The Society may permit the use of any other fixed fire-extinguishing system that has been shown that it is not less effective by full-scale test in conditions simulating a flowing petrol fire in a vehicle space or a ro-ro space in controlling fires likely to occur in such a space.

4. When fixed water pressure spraying systems are provided, in view of the serious loss of stability which could arise due to large quantities of water accumulating on the deck or decks during the operation of the fixed pressure water-spraying system, drainage and puping arrangements are to be provided. The drainage and pumping arrangements are to be such as to prevent the build-up of free surfaces. In such case, the drainage system is to be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The drainage system valves are to be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. Bilge wells are to be of sufficient holding capacity and are to be arranged at the side shell of the ship at a distance from each other of not more than 40 *m* in each watertight compartment. If this is not possible, suitable measures as deemed appropriate by the Society are to be taken to limit the adverse effect upon stability of the added weight and free surface of water in its approval of the stability information. Such information is to be included in the stability information.

20.5.2 Portable Fire Extinguishers

1. Portable extinguishers are to be provided at each deck level in each hold or compartment where vehicles are carried, spaced not more than 20 *m* apart on both sides of the space. At least one portable extinguisher is to be located at each access to such a cargo space.

2. In addition to the provision of **-1** above, the following fire extinguishing appliances are to be provided in vehicle and ro-ro spaces intended for carriage of motor vehicles with fuel in their tanks for their own propulsion:

(1) At least three water fog applicators deemed as appropriate by the Society; and one portable foam applicator unit complying with the provisions of Chapter 24 provided that at least two such units are available in the ship for use in such spaces.

Chapter 21 SPECIAL REQUIREMENTS FOR SMALL SHIPS AND SHIPS FOR RESTRICTED SERVICE

21.1 General

21.1.1 Application

Requirements of this Chapter apply to the following ships:

(1) Ships of less than 500 *gross tonnage*;

(2) Ships not engaged on international voyages;

(3) Ships registered under the classification character, affixed with "*Coasting Service*" (*NC*), "*Smooth Water Service"* (*AP*) or other similar notations (hereinafter referred to as ships for restricted service);

(4) Ships solely engaged in fishing (hereinafter referred to as "fishing vessels"); and

(5) Ships for which the requirements specified in **Chapters 4** to **20** are not directly applicable.

21.2 Special Requirements

21.2.1 Requirements for Ships of less than 500 gross tonnage

With respect to ships of less than 500 *gross tonnage*, for which it is difficult to comply the requirements of **Chapters 4** to **34** (except **Chapters 17** and **21**) regarding to the design of subdivision or installations, special consideration may be given by the Society.

21.2.2 Requirements for Ships not engaged on International Voyages

Ships not engaged on international voyages are, in general, to comply with the requirements in this Part (except this Chapter). However, where the ships are limited in size and service area, special consideration may be given by the Society.

21.2.3 Requirements for Ships for Restricted Service

1. With respect to ships for restricted service, regarding to characters of service area where the ships are intended for, the requirements of **Chapters 4** to **34** (except **Chapters 17** and **21**) may be modified by the Society.

21.2.4 Requirements for Fishing Vessels

With respect to fishing vessels, regarding to the unique purpose of the vessels, special consideration may be given to the requirements in **Chapters 4** to **34** (except **Chapters 17** and **21**) by the Society.

21.2.5 Requirements for Other Ships

With respect to ships for which the requirements specified in Chapters 4 to 20 and 21.2.1 to 21.2.4 are not directly applicable, regarding to the purpose and construction, special consideration may be given to the application of the requirements in Chapters 4 to 34 (except Chapters 17 and 21) by the Society.

Chapter 22 INTERNATIONAL SHORE CONNECTIONS

22.1 General

22.1.1 Application

This chapter details the specifications for international shore connections as required by this Part.

22.2 Engineering Specifications

22.2.1 Standard Dimensions

Standard dimensions of flanges for the international shore connection are to be in accordance with **Table 22.1** and **Figure 22.1**.

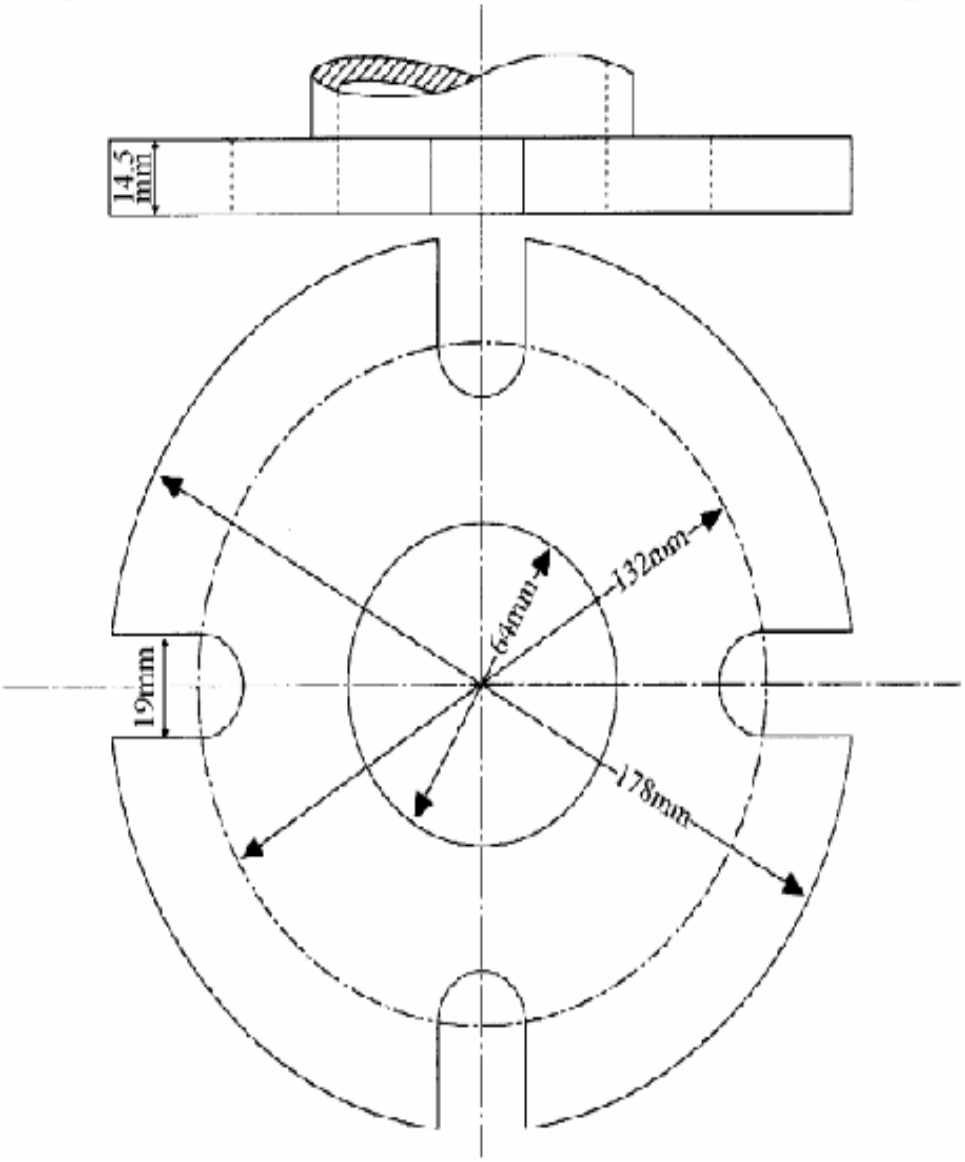
22.2.2 Materials and Accessories

International shore connections are to be of steel or other equivalent material and are to be designed for 1.0 N/mm^2 services. The flange is to have a flat face on one side and, on the other side, it is to be permanently attached to a coupling that will fit the ship's hydrant and hose. The connection is to be kept aboard the ship together with a gasket of any material suitable for 1.0 N/mm^2 services, together with four bolts of 16 *mm* diameter and 50 *mm* in length, four 16 *mm* nuts, and eight washers.

Table 22.1 Standard Dimensions for International Shore Connection

Description	Dimension
Outside diameter	178 *mm*
Inside diameter	64 *mm*
Bolt circle diameter	132 *mm*
Slots in flange	4 holes 19 *mm* in diameter spaced equidistantly
Flange thickness	14.5 *mm* minimum
Bolt and nuts	4, each of 16 *mm* diameter , 50 *mm* in length

Figure 22.1 International Shore Connection (Ship)


14.5 mm
64mm
132mm
19mm
178mm

Chapter 23 PERSONNEL PROTECTION

23.1 General

23.1.1 Application

This chapter details the specifications for personnel protection as required by this Part.

23.2 Engineering Specifications

23.2.1 Fire-fighter s Outfit

1. A fire-fighter's outfit is to consist of a set of the following personal equipment and a breathing apparatus specified in **-2** below with a lifeline specified in **-3** below.

(1) Protective clothing of material to protect the skin from the heat radiating from the fire and from burns and scalding by steam. The outer surface is to be water-resistant;

(2) Boots of rubber or other electrically non-conducting material;

(3) Rigid helmet providing effective protection against impact;

(4) Electric safety lamp (hand lantern) of an approved type with a minimum burning period of 3 *hours*. Electric safety lamps on tankers and those intended to be used in hazardous areas are to be of an explosion-proof type; and

(5) Axe with a handle provided with high-voltage insulation.

2. Breathing apparatus

Breathing apparatus is to be a self-contained compressed air-operated breathing apparatus for which, the volume of air contained in the cylinders is to be at least 1,200 *l*, or other self-contained breathing apparatus which is to be capable of functioning for at least 30 *minutes*. All air cylinders for breathing apparatus are to be interchangeable.

3. Lifelines

For each breathing apparatus a fireproof lifeline of at least 30 *m* in length is to be provided. The lifeline is to have enough strength for statical load of 3.5 *kN* for 5 *minutes*. The lifeline is to be capable of being attached by means of a snap-hook to the harness of the apparatus or to a separate belt in order to prevent the breathing apparatus becoming detached when the lifeline is operated.

23.2.2 Emergency Escape Breathing Device (EEBD)

1. General Requirements

(1) An *EEBD* is a supplied-air or oxygen device only used for escape from a compartment that has a hazardous atmosphere and is to be of an approved type.

(2) *EEBD*s are not to be used for fighting fires, entering oxygen deficient voids or tanks, or worn by fire-fighters. In these events, a self-contained breathing apparatus, which is specifically suited for such applications, is to be used.

2. Definitions

(1) Face piece means a face covering that is designed to form a complete seal around the eyes, nose and mouth which is secured in position by a suitable means.

(2) Hood means a head covering which completely covers the head, neck, and may cover portions of the shoulders.

(3) Hazardous atmosphere means any atmosphere that is immediately dangerous to life or health.

3. Particulars

(1) The *EEBD* is to have a service duration of at least 10 *minutes*.

(2) The *EEBD* is to include a hood or full face piece, as appropriate, to protect the eyes, nose and mouth during escape. Hoods and face pieces are to be constructed of flame resistant materials and include a clear window for viewing.

(3) An inactivated *EEBD* is to be capable of being carried hands-free.

(4) An *EEBD*, when stored, is to be suitably protected from the environment.

(5) Brief instructions or diagrams clearly illustrating the use are to be clearly printed on the *EEBD*. The donning procedures are to be quick and easy to allow for situations where there is little time to seek safety from a hazardous atmosphere.

4. Markings

Maintenance requirements, manufacturer s trademark and serial number, shelf life with accompanying manufacture date and name of approving authority are to be printed on each *EEBD*. All *EEBD* training units are to be clearly marked.

Chapter 24 FIRE EXTINGUISHERS

24.1 General

24.1.1 Application

This chapter details the specifications for fire extinguishers as required by this Part.

24.1.2 Type Approval

All fire extinguishers are to be of approved types and designs.

24.2 Engineering Specifications

24.2.1 Fire Extinguisher

1. Quantity of medium

(1) Each powder or carbon dioxide extinguisher is to have a capacity of at least 5 *kg*, and each foam extinguisher is to have a capacity of at least 9 *l*. The mass of all portable fire extinguishers is not to exceed 23 *kg*, and they are to have a fire-extinguishing capability at least equivalent to that of a 9 *l* fluid extinguisher.

(2) The equivalents of fire extinguishers are to be determined by the Society.

2. Recharging

Only refills approved for the fire extinguisher in question are to be used for recharging.

24.2.2 Portable Foam Applicators

1. A portable foam applicator unit is to consist of a foam nozzle/branch pipe, either of a self-inducting type or in combination with a separate inductor, capable of being connected to the fire main by a fire hose, together with a portable tank containing at least 20 *l* of foam concentrate and at least one spare tank of foam concentrate of the same capacity.

2. Capacity and performance of foam applicators

(1) The nozzle/branch pipe and inductor are to be capable of producing effective foam suitable for extinguishing an oil fire, at a foam solution flow rate of at least 200 *l*/*min* at the nominal pressure in the fire main.

(2) The foam concentrate is to be approved by the Society.

(3) The values of the foam expansion and drainage time of the foam produced by the portable foam applicator unit are not to differ more than 10% of that determined in **(2)** above.

(4) The portable foam applicator unit is to be designed to withstand clogging, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered on ships.

Chapter 25 FIXED GAS FIRE-EXTINGUISHING SYSTEMS

25.1 General

25.1.1 Application

This chapter details the specifications for fixed gas fire-extinguishing systems as required by this Part.

25.2 Engineering Specifications

25.2.1 General Requirements

1. Fire-extinguishing medium

(1) Where the quantity of the extinguishing medium is required to protect more than one space, the quantity of medium available need not be more than the largest quantity required for any one space so protected. The system is to be fitted with normally closed control valves arranged to direct agent into appropriate space.

(2) The volume of starting air receivers, converted to free air volume, is to be added to the gross volume of the machinery space when calculating the necessary quantity of extinguishing medium. Alternatively, a discharge pipe from the safety valves may be fitted and led directly to the open air.

(3) Means are to be provided for the crew to safely check the quantity of medium in the containers.

(4) Containers for the storage of fire-extinguishing medium and associated pressure components are to be designed to pressure codes of practice to the satisfaction of the Society having regard to their locations and maximum ambient temperatures expected in service.

2. Installation requirements

(1) The piping for the distribution of fire-extinguishing medium is to be arranged and discharge nozzles so positioned that a uniform distribution of medium is obtained. System flow calculations are to be performed using a calculation technique acceptable to Society.

(2) Except as otherwise permitted by the Society, pressure containers required for the storage of fire-extinguishing medium, other than steam, are to be located outside protected spaces in accordance with **10.4.3**.

(3) Spare parts for the system are to be stored on board and be to the satisfaction of the Society.

3. System control requirements

(1) The necessary pipes for conveying fire-extinguishing medium into the protected spaces are to be provided with control valves so marked as to indicate clearly the spaces to which the pipes are led. Suitable provision is to be made to prevent inadvertent release of the medium into the space. The pipes may pass through accommodations providing that they are of substantial thickness and that their tightness is verified with a pressure test, after their installation, at a pressure head not less than 5 N/mm^2. In addition, pipes passing through accommodation areas are to be joined only by welding and are not to be fitted with drains or other openings within such spaces. The pipes are not to pass through refrigerated spaces.

(2) Means are to be provided for automatically giving audible warning of the release of fire-extinguishing medium into any ro-ro spaces and other spaces in which personnel normally work or to which they have access. The pre-discharge alarm is to be automatically activated, e.g. by opening of the release cabinet door. The alarm is to operate for the length of time needed to evacuate the space, but in no case less than 20 *seconds* before the medium is released. Conventional cargo spaces and small spaces (such as compressor rooms, paint lockers, etc.) with only a local release need not be provided with such an alarm.

(3) The means of control of any fixed gas fire-extinguishing system are to be readily accessible and simple to operate and are to be grouped together in as few locations as possible at positions not likely to be cut off by a fire in a protected space. At each location there are to be clear instructions relating to the operation of the system having regard to the safety of personnel.

(4) Automatic release of fire-extinguishing medium is not to be permitted, except as permitted by the Society.

25.2.2 Carbon Dioxide Systems

1. Quantity of fire extinguishing medium

(1) For cargo spaces the quantity of carbon dioxide available is, unless otherwise provided, to be sufficient to give a minimum volume of free gas equal to 30% of the gross volume of the largest cargo space so protected in the ship.

(2) For machinery spaces the quantity of carbon dioxide carried is to be sufficient to give a minimum volume of free gas equal to the larger of the following volumes, either:

(a) 40% of the gross volume of the largest machinery space so protected, the volume to exclude that part of the casing above the level at which the horizontal area of the casing is 40% or less of the horizontal area of the space concerned taken midway between the tank top and the lowest part of the casing; or

(b) 35% of the gross volume of the largest machinery space protected, including the casing;

(3) The percentages specified in (2) above may be reduced to 35% and 30%, respectively, for ships of less than 2,000 *gross tonnage*.

(4) For the purpose of this Chapter the volume of free carbon dioxide is to be calculated at 0.56 m^3/kg.

(5) For machinery spaces the fixed piping system is to be such that 85% of the gas can be discharged into the space within 2 *minutes*.

2. Controls of carbon dioxide systems protecting ro-ro spaces or other spaces which are normally manned or where personnel can be expected to enter or access, are to comply with the following requirements:

(1) Two separate controls are to be provided for releasing carbon dioxide into a protected space and to ensure the activities of the alarm. One control is to be used to discharge the gas from its storage containers and a second control is to be used for opening the valve of the piping which conveys the gas into the protected space; and

(2) The two controls are to be located inside a release box clearly identified for the particular space. If the box containing the controls is to be locked, a key to the box is to be in a break-glass-type enclosure conspicuously located adjacent to the box.

3. In cases where a low pressure carbon dioxide system is fitted to comply with this regulation, the following (**1**) to (**13**) apply:

(1) System control devices and refrigerating plants are to be located within the same room as where pressure vessels are stored.

(2) The rated amount of liquid carbon dioxide is to be stored in vessel(s) under the working pressure in the range of 1.8 N/mm^2 to 2.2 N/mm^2. The normal liquid charge in the container is to be limited to provide sufficient vapour space to allow for expansion of the liquid under the maximum storage temperatures than can be obtained corresponding to the setting of the pressure relief valves, but is not to exceed 95% of the volumetric capacity of the container.

(3) Vessels are to be provided with the following equipment:

(a) Pressure gauge

(b) High pressure alarm (preset level is not to be more than setting of the relief valve)

(c) Low pressure alarm (preset level is not to be less than 1.8 *MPa*)

(d) Branch pipes with stop valves for filling the vessels

(e) Carbon dioxide gas discharge pipes

(f) Liquid CO_2 level indicator (fitted on the vessel(s)); and

(g) Two safety valves

(4) The two safety relief valves are to be arranged so that either valve can be shut off while the other is connected to the vessel. The setting of the relief valves is not to be less than 1.1 times working pressure. The capacity of each valve is to be such that the vapours generated under fire condition can be discharged with a pressure rise not more than 20% above the setting pressure. The discharge from the safety valves is to be led to the open.

(5) Vessel(s) and outgoing pipes permanently filled with carbon dioxide are to have thermal insulation preventing the operation of the safety valve for a period of 24 h after de-energizing the plant, at an ambient temperature of 45°C and an initial pressure equal to the starting pressure of the refrigeration unit.

(6) Vessel(s) are to be serviced by two automated completely independent refrigerating units solely intended for this purpose, each comprising a compressor and the relevant prime mover, evaporator and condenser.

(7) The refrigerating capacity and automatic control of each unit are to be so as to maintain the required temperature under conditions of continuous operation during 24 h at sea temperatures up to 32°C and ambient air temperatures up to 45°C.

(8) Each electric refrigerating unit is to be supplied from the main switchboard busbars by a separate feeder.

(9) Cooling water supply to the refrigerating plant (in cases where required) are to be provided from at least two circulating pumps one of which is being used as a stand-by. The stand-by pump may be a pump used for other services so long as its use for cooling would not interfere with any other essential service of the ship. Cooling water is to be taken from not less than two sea connections, preferably one port and one starboard.

(10) Safety relief devices are to be provided in each section of pipe that may be isolated by block valves and in which there could be a build-up of pressure in excess of the design pressure of any of the components.

(11) Audible and visual alarms are to be given in a central control station or where a central control station is not provided, when:

(a) The pressure in the vessel(s) reaches the low and high values according to **(3)(b)** or **(c)** above;

(b) Any one of the refrigerating units fails to operate; or

(c) The lowest permissible level of the liquid in the vessels is reached.

(12) If the system serves more than one space, means for control of discharge quantities of CO_2 are to be provided, e.g. automatic timer or accurate level indicators located at the control position(s).

(13) If a device is provided which automatically regulates the discharge of the rated quantity of carbon dioxide into the protected spaces, it is to be also possible to regulate the discharge manually.

25.2.3 Requirements of Steam Systems

The boiler or boilers available for supplying steam are to have an evaporation of at least 1.0 *kg* of steam per hour for each 0.75 m^3 of the gross volume of the largest space so protected. In addition to complying with the foregoing requirements the systems in all respects are to be as determined by, and to the satisfaction of, the Society.

25.2.4 Systems using Gaseous Products of Fuel Combustion

1. General Requirements

Where gas other than carbon dioxide or steam, as permitted by 25.2.3, is produced on the ship and is used as a fire-extinguishing medium, the system is to comply with the requirements in **-2** below.

2. Requirements of the systems

(1) Gas is to be a gaseous product of fuel combustion in which the oxygen content, the carbon monoxide content, the corrosive elements and any solid combustible elements in a gaseous product are to have been reduced to a permissible minimum.

(2) Capacity of fire-extinguishing systems

(a) Where such gas is used as the fire-extinguishing medium in a fixed fire-extinguishing system for the protection of machinery spaces, it is to afford protection equivalent to that provided by a fixed system using carbon dioxide as the medium.

(b) Where such gas is used as the fire-extinguishing medium in a fixed fire-extinguishing system for the protection of cargo spaces, a sufficient quantity of such gas is to be available to supply hourly a volume of free gas at least equal to 25% of the gross volume of the largest space protected in this way for a period of 72 *hours*.

25.2**.5** Equivalent Fixed Gas Fire-extinguishing Systems for Machinery Spaces and Cargo Pump Rooms Fixed gas fire-extinguishing systems equivalent to those specified in 25.2.2 through 25.2.4 are to be approved by the Society.

Chapter 26 FIXED FOAM FIRE-EXTINGUISHING SYSTEMS

26.1 General

26.1.1 Application

This chapter details the specifications for fixed foam-extinguishing systems for the protection of machinery spaces in accordance with **10.4**, cargo pump-rooms in accordance with **10.9.1(2)** and vehicle and ro-ro spaces in accordance with regulation **20.5.1**. This chapter does not apply to cargo pump-rooms of chemical tankers carrying liquid cargoes referred to in **1.2.2-2**, unless the Society specifically accepts the use of these systems based on additional tests with alcohol-based fuel and alcohol resistant foam.

26.2 Definitions

26.2.1 Design Filling Rate

Design filling rate is at least the minimum nominal filling rate used during the approval tests specified in **26.3.1-3**.

26.2.2 Foam

Foam is the extinguishing medium produced when foam solution passes through a foam generator and is mixed with air.

26.2.3 Foam Solution

Foam solution is a solution of foam concentrate and water.

26.2.4 Foam Concentrate

Foam concentrate is a liquid which, when mixed with water in the appropriate concentration forms a foam solution.

26.2.5 Foam Delivery Ducts

Foam delivery ducts are supply ducts for introducing high-expansion foam into the protected space from foam generators located outside the protected space.

26.2.6 Foam Mixing Ratio

Foam mixing ratio is the percentage of foam concentrate mixed with water forming the foam solution.

26.2.7 Foam Generators

Foam generators are discharge devices or assemblies through which high-expansion foam solution is aerated to form foam that is discharged into the protected space. Foam generators using inside air typically consist of a nozzle or set of nozzles and a casing. The casing is typically made of perforated steel/stainless steel plates shaped into a box that enclose the nozzle(s). Foam generators using outside air typically consist of nozzles enclosed within a casing that spray onto a screen. An electric, hydraulic or pneumatically driven fan is provided to aerate the solution.

26.2.8 High-expansion Foam Fire-extinguishing Systems

High-expansion foam fire-extinguishing systems are fixed total flooding extinguishing systems that use either inside air or outside air for aeration of the foam solution. A high-expansion foam system consists of both the foam generators and the dedicated foam concentrate approved during the test specified in **26.3.1-3**.

26.2.9 Inside Air Foam System

Inside air foam system is a fixed high-expansion foam fire-extinguishing system with foam generators located inside the protected space and drawing air from that space.

26.2.10 Nominal Flow Rate

Nominal flow rate is the foam solution flow rate expressed in *l/minute*.

26.2.11 Nominal Application Rate

Nominal application rate is the nominal flow rate per area expressed in *l/minute/m*^{2}.

26.2.12 Nominal Foam Expansion Ratio

Nominal foam expansion ratio is the ratio of the volume of foam to the volume of foam solution from which it was made, under non-fire conditions, and at an ambient temperature of e.g. around 20^o C.

26.2.13 Nominal Foam Production

Nominal foam production is the volume of foam produced per time unit, i.e. nominal flow rate times nominal foam expansion ratio, expressed in m^3*/minute*.

26.2.14 Nominal Filling Rate

Nominal filling rate is the ratio of nominal foam production to the area, i.e. expressed in *m/minute*.

26.2.15 Nominal Filling Time

Nominal filling time is the ratio of the height of the protected space to the nominal filling rate, i.e. expressed in *minutes*.

26.2.16 Outside Air Foam System

Outside air foam system is a fixed high-expansion foam system with foam generators installed outside the protected space that are directly supplied with fresh air.

26.3 Fixed High-expansion Foam Fire-extinguishing Systems

26.3.1 Principal Performance

1. The system is to be capable of manual release, and is to be designed to produce foam at the required application rate within 1 *minute* of release. Automatic release of the system is not to be permitted unless appropriate operational measures or interlocks are provided to prevent any local application systems required by **10.5.5** from interfering with the effectiveness of the system.

2. The foam concentrates are to be approved by the Society. Different foam concentrate types are not to be mixed in a high-expansion foam system.

3. The system is to be capable of fire extinction and manufactured and tested based on the standards to the satisfaction of the Society.

4. The system and its components are to be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, clogging and corrosion normally encountered on ships. Piping, fittings and related components inside the protected spaces (except gaskets) are to be designed to withstand 925°C.

5. System piping, foam concentrate storage tanks, components and pipe fittings in contact with the foam concentrate are to be compatible with the foam concentrate and be constructed of corrosion resistant materials such as stainless steel, or equivalent. Other system piping and foam generators are to be full galvanized steel or equivalent. Distribution pipework is to have self-draining capability.

6. Means for testing the operation of the system and assuring the required pressure and flow are to be provided by pressure gauges at both inlets (water and foam concentrate supply) and at the outlet of the foam proportioner. A test valve is to be installed on the distribution piping downstream of the foam proportioner, along with orifices which reflect the calculated pressure drop of the system. All sections of piping are to be provided with connections for flushing, draining and purging with air. All nozzles are to be able to be removed for inspection in order to prove clear of debris.

7. Means are to be provided for the crew to safely check the quantity of foam concentrate and take periodic control samples for foam quality.

8. Operating instructions for the system are to be displayed at each operating position.

9. Spare parts are to be provided based on the manufacturer's instruction.

10. If an internal combustion engine is used as a prime mover for the seawater pump for the system, the fuel oil tank to the prime mover is to contain sufficient fuel to enable the pump to run on full load for at least 3 *h* and sufficient reserves of fuel are to be available outside the machinery space of category *A* to enable the pump to be run on full load for an additional 15 *h*. If the fuel tank serves other internal combustion engines simultaneously, the total fuel tank capacity is to be adequate for all connected engines.

11. The arrangement of foam generators and piping in the protected space are not to interfere with access to the installed machinery for routine maintenance activities.

12. The system source of power supply, foam concentrate supply and means of controlling the system are to be readily accessible and simple to operate, and are to be arranged at positions outside the protected space not likely to be cut off by a fire in the protected space. All electrical components directly connected to the foam generators are to have at least an IP 54 rating.

13. The piping system is to be sized in accordance with a hydraulic calculation technique to ensure availability of flows and pressures required for correct performance of the system.

14. The arrangement of the protected spaces is to be such that they may be ventilated as the space is being filled with foam. Procedures are to be provided to ensure that upper level dampers, doors and other suitable openings are kept open in case of a fire. For inside air foam systems, spaces below 500 m^3 need not comply with this requirement.

15. Onboard procedures are to be established to require personnel re-entering the protected space after a system discharge to wear breathing apparatus to protect them from oxygen deficient air and products of combustion entrained in the foam blanket.

16. Installation plans and operating manuals are to be supplied to the ship and be readily available on board. A list or plan is to be displayed showing spaces covered and the location of the zone in respect of each section. Instructions for testing and maintenance are to be available on board.

17. All installation, operation and maintenance instructions/plans for the system are to be in the working language of the ship. If the working language of the ship is not English, French, nor Spanish, a translation into one of these languages is to be included.

18. The foam generator room is to be ventilated to protect against overpressure, and is to be heated to avoid the possibility of freezing.

19. The quantity of foam concentrate available is to be the following **(1)** or **(2)**, whichever is greater:

(1) sufficient to produce a volume of foam equal to at least five times the volume of the largest protected space enclosed by steel bulkheads, at the nominal expansion ratio; or

(2) enough for 30 *minutes* of full operation for the largest protected space, whichever is greater.

20. Machinery spaces, cargo pump-rooms, vehicle spaces and ro-ro spaces are to be provided with audible and visual alarms within the protected space warning of the release of the system. The alarms are to operate for the length of time needed to evacuate the space, but in no case less than 20 *seconds*.

26.3.2 Inside Air Foam Systems

1. Systems for the protection of machinery spaces and cargo pump-rooms

(1) The system is to be supplied by both main and emergency sources of power. The emergency power supply is to be provided from outside the protected space.

(2) Sufficient foam-generating capacity is to be provided to ensure the minimum design filling rate for the system is met and in addition is to be adequate to completely fill the largest protected space within 10 *minutes*.

(3) The arrangement of foam generators are, in general, to be designed based on the results of the test specified in 26.3.1-3. A minimum of two generators is to be installed in every space containing combustion engines, boilers, purifiers, and similar equipment. Small workshops and similar spaces may be covered with only one foam generator.

(4) Foam generators are to be uniformly distributed under the uppermost ceiling in the protected spaces including the engine casing. The number and location of foam generators are to be adequate to ensure all high risk areas are protected in all parts and at all levels of the spaces. Extra foam generators may be required in obstructed locations. The foam generators are to be arranged with at least 1 *m* free space in front of the foam outlets, unless tested with less clearance. The generators are to be located behind main structures, and above and away from engines and boilers in positions where damage from an explosion is unlikely.

2. Systems for the protection of vehicle and ro-ro spaces

(1) The system is to be supplied by the ship's main power source. An emergency power supply is not required.

(2) Sufficient foam-generating capacity is to be provided to ensure the minimum design filling rate for the system is met and in addition is to be adequate to completely fill the largest protected space within 10 *minutes*. However, for systems protecting vehicle and ro-ro spaces, with decks that are reasonably gas-tight and that have a deck height of 3 *m* or less, the filling rate is to be not less than two thirds of the design filling rate and in addition sufficient to fill the largest protected space within 10 *minutes*.

(3) The system may be divided into sections, however, the capacity and design of the system are to be based on the protected space demanding the greatest volume of foam. Adjacent protected spaces need not be served simultaneously if the boundaries between the spaces are "*A"* class divisions.

(4) The arrangement of foam generators are, in general, to be designed based on the results of the test specified in 26.3.1-3. The number of generators may be different, but the minimum design filling rate determined during the test specified in 26.3.1-3 is to be provided by the system. A minimum of two generators is to be installed in every space. The foam generators are to be arranged to uniformly distribute foam in the protected spaces, and the layout is to take into consideration obstructions that can be expected when cargo is loaded on board. As a minimum, generators are to be located on every second deck, including movable decks. The horizontal spacing of the generators is to ensure rapid supply of foam to all parts of the protected space. This is to be established on the basis of full scale tests.

(5) The foam generators are to be arranged with at least 1 *m* free space in front of the foam outlets, unless tested with less clearance.

26.3.3 Outside Air Foam Systems

1. Systems for the protection of machinery spaces and cargo pump-rooms

(1) The system is to be supplied by both main and emergency sources of power. The emergency power supply is to be provided from outside the protected machinery space.

(2) Sufficient foam-generating capacity is to be provided to ensure the minimum design filling rate for the system is met and in addition is to be adequate to completely fill the largest protected space within 10 *minutes*.

(3) The arrangement of foam delivery ducts are, in general, to be designed based on the results of the test specified in 26.3.1-3. The number of ducts may be different, but the minimum design filling rate determined during the test specified in 26.3.1-3 is to be provided by the system. A minimum of two ducts is to be installed in every space containing combustion engines, boilers, purifiers, and similar equipment. Small workshops and similar spaces may be covered with only one duct.

(4) Foam delivery ducts are to be uniformly distributed under the uppermost ceiling in the protected spaces including the engine casing. The number and location of ducts are to be adequate to ensure all high risk areas are protected in all parts and at all levels of the spaces. Extra ducts may be required in obstructed locations. The ducts are to be arranged with at least 1 *m* free space in front of the foam delivery ducts, unless tested with less clearance. The ducts are to be located behind main structures, and above and away from engines and boilers in positions where damage from an explosion is unlikely.

(5) The arrangement of the foam delivery ducts are to be such that a fire in the protected space will not affect the foam-generating equipment. If the foam generators are located adjacent to the protected space, foam delivery ducts are to be installed to allow at least 450 *mm* of separation between the generators and the protected space, and the separating divisions are to be class "*A*-60" rated. Foam delivery ducts are to be constructed of steel having a thickness of not less than 5 *mm*. In addition, stainless steel dampers (single or multi-bladed) with a thickness of not less than 3 *mm* are to be installed at the openings in the boundary bulkheads or decks between the foam generators and the protected space. The dampers are to be automatically operated (electrically, pneumatically or hydraulically) by means of remote control of the foam generator related to them, and arranged to remain closed until the foam generators begin operating.

6) The foam generators are to be located where an adequate fresh air supply can be arranged.

2. Systems for the protection of vehicle and ro-ro spaces

(1) The system is to be supplied by the ship's main power source. An emergency power supply is not required.

(2) Sufficient foam-generating capacity is to be provided to ensure the minimum design filling rate for the system is met and in addition is to be adequate to completely fill the largest protected space within 10 *minutes*. However, for systems protecting vehicle and ro-ro spaces, with decks that are reasonably gas-tight and that have a deck height of 3 *m* or less, the filling rate is to be not less than two thirds of the design filling rate and in addition sufficient to fill the largest protected space within 10 *minutes*.

(3) The system may be divided into sections, however, the capacity and design of the system are to be based on the protected space demanding the greatest volume of foam. Adjacent protected spaces need not be served simultaneously if the boundaries between the spaces are "*A"* class divisions.

(4) The arrangement of foam delivery ducts are, in general, to be designed based on the results of the test specified in **26.3.1-3**. The number of ducts may be different, but the minimum design filling rate determined during the test specified in **26.3.1-3** is to be provided by the system. A minimum of two ducts is to be installed in every space. The foam generators are to be arranged to uniformly distribute foam in the protected spaces, and the layout is to take into consideration obstructions that can be expected when cargo is loaded on board. As a minimum, ducts are to be led to every second deck, including movable decks. The horizontal spacing of the ducts is to ensure rapid supply of foam to all parts of the protected space. This is to be established on the basis of full scale tests.

(5) The system is to be arranged with at least 1 *m* free space in front of the foam outlets, unless tested with less clearance.

(6) The arrangement of the foam delivery ducts is to be such that a fire in the protected space will not affect the foam-generating equipment. If the foam generators are located adjacent to the protected space, foam delivery ducts are to be installed to allow at least 450 *mm* of separation between the generators and the protected space, and the separating divisions are to be class "*A*-60" rated. Foam delivery ducts are to be constructed of steel having a thickness of not less than 5 *mm*. In addition, stainless steel dampers (single or multi-bladed) with a thickness of not less than 3 *mm* are to be installed at the openings in the boundary bulkheads or decks between the foam generators and the protected space. The dampers are to be automatically operated (electrically, pneumatically or hydraulically) by means of remote control of the foam generator related to them, and arranged to remain closed until the foam generators begin operating.

(7) The foam generators are to be located where an adequate fresh air supply can be arranged.

26.3.4 Systems Using Outside Air with Generators Installed inside the Protected Space

Systems using outside air but with generators located inside the protected space and supplied by fresh air ducts may be accepted by the Society provided that these systems have been shown to have performance and reliability equivalent to systems defined in **26.3.3**. Consideration is to be given to the following minimum design features of the system:

(1) lower and upper acceptable air pressure and flow rate in supply ducts;

(2) function and reliability of damper arrangements;

(3) arrangements and distribution of air delivery ducts including foam outlets; and

(4) separation of air delivery ducts from the protected space.

26.3.5 Installation Testing Requirements

1. After installation, the pipes, valves, fittings and assembled systems are to be tested to the satisfaction of the Society, including functional testing of the power and control systems, water pumps, foam pumps, valves, remote and local release stations and alarms. Flow at the required pressure is to be verified for the system using orifices fitted to the test line. In addition, all distribution piping is to be flushed with freshwater and blown through with air to ensure that the piping is free of obstructions.

2. Functional tests of all foam proportioners or other foam mixing devices are to be carried out to confirm that the mixing ratio tolerance is within +30 to -0 % of the nominal mixing ratio defined by the system approval. For foam proportioners using foam concentrates of Newtonian type with kinematic viscosity equal to or less than 100 *cSt* at 0°C and density equal to or less than 1,100 kg/m^3, this test can be performed with water instead of foam concentrate. Other arrangements are to be tested with the actual foam concentrate.

26.4 Fixed Low-expansion Foam Fire-extinguishing Systems

26.4.1 Quantity and Foam Concentrates

1. The foam concentrates of low-expansion foam fire-extinguishing systems are to be approved by the Society. Different foam concentrate types are not to be mixed in a low-expansion foam system. Foam concentrates of the same type from different manufacturers are not to be mixed unless they are approved for compatibility.

2. The system is to be capable of discharging through fixed discharge outlets, in no more than 5 *minutes*, a quantity of foam sufficient to produce an effective foam blanket over the largest single area over which oil fuel is liable to spread.

26.4.2 Installation Requirements

1. Means are to be provided for effective distribution of the foam through a permanent system of piping and control valves or cocks to suitable discharge outlets, and for the foam to be effectively directed by fixed sprayers onto other main fire hazards in the protected space. The means for effective distribution of the foam are to be proven acceptable to the Society through calculation or by testing.

2. The means of control of any such systems are to be readily accessible and simple to operate and are to be grouped together in as few locations as possible at positions not likely to be cut off by a fire in the protected space

Chapter 27 FIXED PRESSURE WATER-SPRAYING AND WATER-MIST FIRE-EXTINGUISHING SYSTEMS

27.1 General

27.1.1 Application

This chapter details the specifications for fixed pressure water-spraying and water-mist fire-extinguishing systems as required by this Part.

27.2 Engineering Specifications

27.2.1 Fixed Pressure Water-spraying Fire-extinguishing Systems

Fixed pressure water-spraying fire-extinguishing systems for machinery spaces and cargo pump-rooms are to be approved by the Society.

27.2.2 Equivalent Water-mist Fire-extinguishing Systems

Water-mist fire-extinguishing systems for machinery spaces and cargo pump rooms are to be approved by the Society.

Chapter 28 AUTOMATIC SPRINKLER, FIRE DETECTION AND FIRE ALARM SYSTEMS

28.1 General

28.1.1 Application

This chapter details the specifications for automatic sprinkler, fire detection and fire alarm systems as required to be provided by this Part.

28.2 Engineering Specifications

28.2.1 General Requirements

1. The automatic sprinkler systems are to be of the wet pipe type but small exposed sections may be of the dry pipe type where in the opinion of the Society there is a necessary precaution. Control stations, where water may cause damage to essential equipment, may be fitted with a dry pipe system or a pre-action system. Saunas are to be fitted with a dry pipe system, with sprinkler heads having an operating temperature up to 140ºC.

2. Automatic sprinkler systems equivalent to those specified in 28.2.2 to 28.2.4 are to be approved by the Society.

28.2.2 Sources of Power Supply

There are not to be less than two sources of power supply for the sea water pump and automatic alarm and detection system. If the pump is electrically driven it is to be connected to the main source of electrical power, which is to be capable of being supplied by at least two generators. The feeders are to be so arranged as to avoid galleys, machinery spaces and other enclosed spaces of high fire risk except in so far as it is necessary to reach the appropriate switchboards. One of the sources of power supply for the alarm and detection system is to be an emergency source. Where one of the sources of power for the pump is an internal combustion engine it is, in addition to complying with the provisions of 28.2.4-3, to be so situated that a fire in any protected space will not affect the air supply to the machinery.

28.2.3 Component Requirements

1. Sprinklers

(1) The sprinklers are to be resistant to corrosion by marine atmosphere. In accommodation and service spaces the sprinklers are to come into operation within the temperature range from 68ºC to 79ºC, except that in locations such as drying rooms, where high ambient temperatures might be expected, the operating temperature may be increased by not more than 30ºC above the maximum deckhead temperature.

(2) A quantity of spare sprinkler heads is to be provided for all types and ratings installed on the ship as follows. The number of spare sprinkler heads of any type need not exceed the total number of heads installed of that type.

(a) In the case of total number of heads are less than 300, at least 6 heads for spare.

(b) In the case of total number of heads are between 300 and 1,000, at least 12 heads for spare.

(c) In the case of total number of heads are greater than 1,000, at least 24 heads for spare.

2. Pressure tanks

(1) A pressure tank having a volume equal to at least twice that of the charge of water specified in this subparagraph is to be provided. The tank is to contain a standing charge of fresh water, equivalent to the amount of water which would be discharged in one minute by the pump referred to in **28.2.3-3(2**), and the arrangements is to provide for maintaining an air pressure in the tank such as to ensure that where the standing charge of fresh water in the tank has been used the pressure will be not less than the working pressure of the sprinkler, plus the pressure exerted by a head of water measured from the bottom of the tank to the highest sprinkler in the system. Suitable means of replenishing the air under pressure and of replenishing the fresh water charge in the tank are to be provided. A glass gauge is to be provided to indicate the correct level of the water in the tank.

(2) Means are to be provided to prevent the passage of sea water into the tank.

3. Sprinkler pumps

(1) An independent power pump is to be provided solely for the purpose of continuing automatically the discharge of water from the sprinklers. The pump is to be brought into action automatically by the pressure drop in the system before the standing fresh water charge in the pressure tank is completely exhausted.

(2) The pump and the piping system are to be capable of maintaining the necessary pressure at the level of the highest sprinkler to ensure a continuous output of water sufficient for the simultaneous coverage of a minimum area of 280 m^2 at the application rate specified in **28.2.5-2(3).** The hydraulic capability of the system is to be confirmed by the review of hydraulic calculations, followed by a test of the system, if deemed necessary by the Society.

(3) The pump is to have fitted on the delivery side a test valve with a short open-ended discharge pipe. The effective area through the valve and pipe is to be adequate to permit the release of the required pump output while maintaining the pressure in the system specified in **28.2.3-2(1).**

28.2.4 Installation Requirements

1. Any parts of the system which may be subjected to freezing temperatures in service is to be suitably protected against freezing.

2. Piping arrangements

(1) Sprinklers are to be grouped into separate sections, each of which is to contain not more than 200 sprinklers.

(2) Each section of sprinklers is to be capable of being isolated by one stop valve only. The stop valve in each section is to be readily accessible in a location outside of the associated section or in cabinets within stairway

enclosures. The valve s location is to be clearly and permanently indicated. Means are to be provided to prevent the operation of the stop valves by any undeemed appropriate person.

(3) A test valve is to be provided for testing the automatic alarm for each section of sprinklers by a discharge of water equivalent to the operation of one sprinkler. The test valve for each section is to be situated near the stop valve for that section.

(4) The sprinkler system is to have a connection from the ship's fire main by way of a lockable screw-down non-return valve at the connection which will prevent a backflow from the sprinkler system to the fire main.

(5) A gauge indicating the pressure in the system is to be provided at each section stop valve and at a central station.

(6) The sea inlet to the pump is to wherever possible be in the space containing the pump and is to be so arranged that when the ship is afloat it will not be necessary to shut off the supply of sea water to the pump for any purpose other than the inspection or repair of the pump.

3. The sprinkler pump and tank are to be situated in a position reasonably remote from any machinery space of category *A* and are not to be situated in any space required to be protected by the sprinkler system.

28.2.5 System Control Requirements

1. Ready availability

(1) Any required automatic sprinkler, fire detection and fire alarm system is to be capable of immediate operation at all times and no action by the crew is to be necessary to set it in operation.

(2) The automatic sprinkler system is to be kept charged at the necessary pressure and to have provision for a continuous supply of water as required in this chapter.

2. Alarm and indication

(1) Each section of sprinklers is to include means for giving a visual and audible alarm signal automatically at one or more indicating units whenever any sprinkler comes into operation. Such alarm systems are to be such as to indicate if any fault occurs in the system. Such units are to indicate in which section served by the system fire has occurred and are to be centralized on the navigating bridge or in the continuously manned central control station and, in addition, visible and audible alarms from the unit are to be placed in a position other than on the navigating bridge, so as to ensure that the indication of fire is immediately received by the crew.

(2) Switches are to be provided at one of the indicating positions referred to in (1) above which will enable the alarm and the indicators for each section of sprinklers to be tested.

(3) Sprinklers are to be placed in an overhead position and spaced in a suitable pattern to maintain an average application rate of not less than 5 l/m^2 per minute over the nominal area covered by the sprinklers. However, the Society may permit the use of sprinklers providing such an alternative amount of water suitably distributed as has been shown to the satisfaction of the Society to be not less effective.

(4) A list or plan is to be displayed at each indicating unit showing the spaces covered and the location of the zone in respect of each section. Suitable instructions for testing and maintenance are to be available.

3. Means are to be provided for testing the automatic operation of the pump on reduction of pressure in the system.

Chapter 29 FIXED FIRE DETECTION AND FIRE ALARM SYSTEMS

29.1 General

29.1.1 Application

This chapter details the specifications for fixed fire detection and fire alarm systems as required by this Part.

29.1.2 Definitions

1. *Section* means a group of fire detectors and manually operated call points as reported in the indicating unit(s).

2. *Section identification capability* means a system with the capability of identifying the section in which a detector or manually operated call point has activated.

3. *Individually identifiable* means a system with the capability to identify the exact location and type of detector or manually activated call point which has activated, and which can differentiate the signal of that device from all others.

29.2 Engineering Specifications

29.2.1 General Requirements

1. Any required fixed fire detection and fire alarm system with manually operated call points is to be capable of immediate operation at all times (this does not require a backup control panel). Notwithstanding this, particular spaces may be disconnected, for example, workshops during hot work and ro-ro spaces during on and off-loading. The means for disconnecting the detectors are to be designed to automatically restore the system to normal surveillance after a predetermined time that is appropriate for the operation in question. The space is to be manned or provided with a fire patrol when detectors required by the Rules are disconnected. Detectors in all other spaces are to remain operational.

2. The fire detection system is to be designed to:

(1) control and monitor input signals from all connected fire and smoke detectors and manual call points;

(2) provide output signals to the navigation bridge, continuously manned central control station or onboard safety centre to notify the crew of fire and fault conditions;

(3) monitor power supplies and circuits necessary for the operation of the system for loss of power and fault conditions; and

(4) the system may be arranged with output signals to other fire safety systems including:

- (a) paging systems, fire alarm or public address systems;
- (b) fan stops;
- (c) fire doors;

(d) fire dampers;

(e) sprinkler systems;

(f) smoke extraction systems;

(g) low-location lighting systems;

(h) fixed local application fire-extinguishing systems;

(i) closed circuit television (CCTV) systems; and

(j) other fire safety systems.

3. The fire detection system may be connected to a decision management system provided that:

(1) the decision management system is proven to be compatible with the fire detection system;

(2) the decision management system can be disconnected without losing any of the functions required by this chapter for the fire detection system; and

(3) any malfunction of the interfaced and connected equipment is not to propagate under any circumstance to the fire detection system.

4. Detectors and manual call points are to be connected to dedicated sections of the fire detection system. Other fire safety functions, such as alarm signals from the sprinkler valves, may be permitted if in separate sections.

5. The system and equipment are to be suitably designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships. All electrical and electronic equipment on the bridge or in the vicinity of the bridge is to be tested for electromagnetic compatibility.

6. Fixed fire detection and fire alarm systems with individually identifiable fire detectors are to be so arranged that:

(1) means are provided to ensure that any fault (*e.g.*, power break, short circuit, earth, etc.) occurring in the section will not prevent the continued individual identification of the remainder of the connected detectors in the section;

(2) all arrangements are made to enable the initial configuration of the system to be restored in the event of failure(*e.g.*, electrical, electronic, informatics, etc.);

(3) the first initiated fire alarm will not prevent any other detector from initiating further fire alarms; and

(4) no section will pass through a space twice. When this is not practical (*e.g.*, for large public spaces), the part of the section which by necessity passes through the space for a second time is to be installed at the maximum possible distance from the other parts of the loop.

7. The fixed fire detection and fire alarm system is, as a minimum, to have section identification capability.

29.2.2 Sources of Power Supply

1. There are to be not less than two sources of power supply for the electrical equipment used in the operation of the fixed fire detection and fire alarm system, one of which is to be an emergency source of power. The supply is to be provided by separate feeders reserved solely for that purpose. Such feeders are to run to an automatic change-over switch situated in or adjacent to the control panel for the fire detection system. The main (respective emergency)

feeder is to run from the main (respective emergency) switchboard to the change-over switch without passing through any other distributing switchboard.

2. There are to be sufficient power to permit the continued operation of the system with all detectors activated, but not more than 100 if the total exceeds this figure.

3. The emergency source of power specified in the preceding **-1** is to be sufficient to maintain the operation of the fire detection and fire alarm system for the periods required and at the end of that period, is to be capable of operating all connected visual and audible fire alarm signals for a period of at least 30 *minutes*.

29.2.3 Component Requirements

1. Detectors

Detectors are to be in accordance with the followings.

(1) Detectors are to be operated by heat, smoke or other products of combustion, flame, or any combination of these factors. Detectors operated by other factors indicative of incipient fires may be considered by the Society provided that they are no less sensitive than such detectors.

(2) Smoke detectors required in all stairways, corridors and escape routes within accommodation spaces are to be certified to operate before the smoke density exceeds 12.5% obscuration per metre, but not until the smoke density exceeds 2% obscuration per metre, when tested according to standards *EN* 54:2001 and *IEC* 60092-504. Alternative testing standards may be used as determined by the Administration. Smoke detectors to be installed in other spaces are to operate within sensitivity limits to the satisfaction of the Society having regard to the avoidance of detector insensitivity or oversensitivity.

(3) Heat detectors are to be certified to operate before the temperature exceeds 78ºC but not until the temperature exceeds 54ºC, when the temperature is raised to those limits at a rate less than 1ºC per minute, when tested according to standards *EN* 54:2001 and *IEC* 60092-504. Alternative testing standards may be used as determined by the Administration. At higher rates of temperature rise, the heat detector is to operate within temperature limits to the satisfaction of the Society having regard to the avoidance of detector insensitivity or oversensitivity.

(4) The operation temperature of heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 130ºC, and up to 140ºC in saunas.

(5) Flame detectors are to be tested according to standards *EN* 54-10:2001 and *IEC* 60092-504. Alternative testing standards may be used as determined by the Administration.

(6) All detectors are to be of a type such that they can be tested for correct operation and restored to normal surveillance without the renewal of any component.

(7) Fixed fire detection and fire alarm systems for cabin balconies are to be approved by the Society.

(8) Detectors fitted in hazardous areas are to be tested and approved for such service. Detectors required by **20.4** and installed in spaces that comply with requirement in **20.3.2-2** need not be suitable for hazardous areas. Detectors fitted in spaces carrying dangerous goods, required by **Chapter 19**, **Table 19.3** **to** comply with requirements in **19.3.2**, are to be suitable for hazardous areas.

2. Control panel

The control panel for the fire detection system is to be tested according to standards *EN* 54-2:1997, *EN* 54-4:1997 and *IEC* 60092-504:2001. Alternative standards may be used as determined by the Administration.

3. Cables

Cables used in the electrical circuits are to be flame retardant according to standard *IEC* 60332-1.

29.2.4 Installation Requirements

1. Sections

(1) Detectors and manually operated call points are to be grouped into sections.

(2) A section of fire detectors which covers a control station, a service space or an accommodation space is not to include a machinery space of category *A*. or a ro-ro space. A section of fire detectors which covers a ro-ro space is not to include a machinery space of category *A*. For fixed fire detection systems with remotely and individually identifiable fire detectors, a section covering fire detectors in accommodation, service spaces and control station is not to include fire detectors in machinery spaces of category *A* or ro-ro spaces.

(3) Where the fire detection system does not include means of remotely identifying each detector individually, no section covering more than one deck within accommodation spaces, service spaces and control stations is to normally be permitted except a section which covers an enclosed stairway. In order to avoid delay in identifying the source of fire, the number of enclosed spaces included in each section is to be limited as determined by the Society. If the detection system is fitted with remotely and individually identifiable fire detectors, the sections may cover several decks and serve any number of enclosed spaces.

2. Positioning of detectors

(1) Detectors are to be located for optimum performance. Positions near beams and ventilation ducts or other positions where patterns of air flow could adversely affect performance and positions where impact or physical damage is likely are to be avoided. Detectors which are located on the overhead are to be a minimum distance of 0.5 m away from bulkheads, except in corridors, lockers and stairways.

(2) The maximum spacing of detectors is to be in accordance with the **Table 29.1**. . The Society may require or permit other spacing based upon test data which demonstrate the characteristics of the detectors. Detectors located below moveable ro-ro decks are to be in accordance with the **Table 29.1**.

(3) Detectors in stairways are to be located at least at the top level of the stair and at every second level beneath.

(4) When fire detectors are installed in freezers, drying rooms, saunas, parts of galleys used to heat food, laundries and other spaces where steam and fumes are produced, heat detectors may be used.

(5) Where a fixed fire detection and fire alarm system is required by **7.5**, spaces having little or no fire risk need not be fitted with detectors. Such spaces include void spaces with no storage of combustibles, private bathrooms, public toilets, fire-extinguishing medium storage rooms, cleaning gear lockers (in which flammable liquids are not stowed), open deck spaces and enclosed promenades having little or no fire risk and that are naturally ventilated by permanent openings.

Table 29.1 Spacing of Detectors

Type of Detector	Maximum floor area per detectors	Maximum distance apart between centre	Maximum distance away from bulkheads
Heat	37 m^2	9 *m*	4.5 *m*
Smoke	74 m^2	11 *m*	5.5 *m*

3. Arrangement of cables

(1) Cables which form part of the system is to be so arranged as to avoid galleys, machinery spaces of category *A*, and other enclosed spaces of high fire risk except where it is necessary to provide for fire detection or fire alarm in such spaces or to connect to the appropriate power supply.

(2) A section with individually identifiable capability is to be arranged so that it cannot be damaged at more than one point by a fire

29.2.5 System Control Requirements

1. Visual and audible fire signals

(1) The activation of any detector or manually operated call point is to initiate a visual and audible fire signal at the control panel and indicating units. If the signals have not received attention with in 2 *minutes* an audible alarm is to be automatically sounded throughout the crew accommodation and service spaces, control stations and machinery spaces of category *A*. This alarm sounder system need not be an integral part of the detection system.

(2) The control panel is to be located on the navigating bridge or in the fire control station

(3) An indicating unit is to be located on the navigation bridge if the control panel is located in the fire control station. Indicating units are, as a minimum, to denote the section in which a detector has activated or manually operated call point has operated.

(4) Clear information is to be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections.

(5) Power supplies and electric circuits necessary for the operation of the system are to be monitored for loss of power or fault conditions as appropriate including:

(a) a single open or power break fault caused by a broken wire;

(b) a single ground fault caused by the contact of a wiring conductor to a metal component; and

(c) a single wire to wire fault caused by the contact of two or more wiring conductors.

Occurrence of a fault condition is to initiate a visual and audible fault signal at the control panel which is to be distinct from a fire signal.

(6) Means to manually acknowledge all alarm and fault signals is to be provided at the control panel. The audible alarm sounders on the control panel and indicating units may be manually silenced. The control panel is to clearly distinguish between normal, alarm, acknowledged alarm, fault and silenced conditions.

(7) The system is to be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared.

(8) When the system is required to sound a local audible alarm within the cabins where the detectors are located, a means to silence the local audible alarms from the control panel are not to be permitted.

(9) In general, audible alarm sound pressure levels at the sleeping positions in the cabins and 1 *m* from the source are to be at least 75 dB(A) and at least 10 dB(A) above ambient noise levels existing during normal equipment operation with the ship under way in moderate weather. The sound pressure level is to be in the 1/3 octave band about the fundamental frequency. Audible alarm signals are not to exceed 120 dB (A).

2. Testing

Suitable instructions and component spares for testing and maintenance are to be provided. Detectors are to be periodically tested using equipment suitable for the types of fires to which the detector is designed to respond. Ships with self-diagnostic systems that have in place a cleaning regime for areas where heads may be prone to contamination may carry out testing in accordance with the requirements of the Society.

Chapter 30 SAMPLE EXTRACTION SMOKE DETECTION SYSTEMS

30.1 General

30.1.1 Application

This chapter details the specifications for sample extraction smoke detection systems as required by this Part.

30.2 Engineering Specifications

30.2.1 General Requirements

1. Wherever in the text of this chapter the word system appears, it means sample extraction smoke detection system. A sample extraction smoke detection system consists of the following main components: smoke accumulators, sampling pipes, three-way valves and control panels.

(1) Smoke accumulators: air collection devices installed at the open ends of the sampling pipes in each cargo hold that perform the physical function of collecting air samples for transmission to the control panel through the sampling pipes, and may also act as discharge nozzles for the fixed-gas fire-extinguishing system, if installed;

(2) Sampling pipes: a piping network that connects the smoke accumulators to the control panel, arranged in sections to allow the location of the fire to be readily identified;

(3) three-way valves: if the system is interconnected to a fixed-gas fire-extinguishing system, three-way valves are used to normally align the sampling pipes to the control panel and, if a fire is detected, the three-way valves are re-aligned to connect the sampling pipes to the fire-extinguishing system discharge manifold and isolate the control panel; and

(4) Control panel: the main element of the system which provides continuous monitoring of the protected spaces for indication of smoke. It typically may include a viewing chamber or smoke sensing units. Extracted air from the protected spaces is drawn through the smoke accumulators and sampling pipes to the viewing chamber, and then to the smoke sensing chamber where the airstream is monitored by electrical smoke detectors. If smoke is sensed, the repeater panel (normally on the bridge) automatically sounds an alarm (not localized). The crew can then determine at the smoke sensing unit which cargo hold is on fire and operate the pertinent three-way valve for discharge of the extinguishing agent.

2. Any required system is to be capable of continuous operation at all times except that systems operating on a sequential scanning principle may be accepted, provided that the interval between scanning the same position twice gives a maximum allowable interval determined as follows:

(1) The interval (I) is to depend on the number of scanning points (N) and the response time of the fans (T), with a 20% allowance:

$I = 1.2 \times T \times N$

However, the maximum allowable interval is not to exceed 120 *seconds* (I_{max} = 120 *seconds*).

3. The system is to be designed, constructed and installed so as to prevent the leakage of any toxic or flammable substances or fire-extinguishing media into any accommodation and service space, control station or machinery space.

4. The system and equipment are to be suitably designed to withstand supply voltage variations and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships and to avoid the possibility of ignition of flammable gas air mixture.

5. The system is to be of a type that can be tested for correct operation and restored to normal surveillance without the renewal of any component.

6. An alternative power supply for the electrical equipment used in the operation of the system is to be provided.

30.2.2 Component Requirements

1. The sensing unit is to be certified to operate before the smoke density within the sensing chamber exceeds 6.65% obscuration per meter.

2. Duplicate sample extraction fans are to be provided. The fans are to be of sufficient capacity to operate with the normal conditions or ventilation in the protected area and the connected pipe size is to be determined with consideration of fan suction capacity and piping arrangement to satisfy the conditions specified in **30.2.4-2(2).** Sampling pipes are to be a minimum of 12 *mm* internal diameter. The fan suction capacity is to be adequate to ensure the response of the most remote area within the required time criteria specified in **30.2.4-2(2).** Means to monitor airflow are to be provided in each sampling line

3. The control panel is to permit observation of smoke in the individual sampling pipe.

4. The sampling pipes are to be so designed as to ensure that, as far as practicable, equal quantities of airflow are extracted from each interconnected accumulator.

5. Sampling pipes are to be provided with an arrangement for periodically purging with compressed air.

6. The control panel for the smoke detection system is to be tested according to standards *EN* 54-2:1997, *EN* 54-4:1997 and *IEC* 60092-504:2001. Alternative standards may be used as determined by the Administration.

30.2.3 Installation Requirements

1. Smoke accumulators

(1) At least one smoke accumulator is to be located in every enclosed space for which smoke detection is required. However, where a space is designed to carry oil or refrigerated cargo alternatively with cargoes for which a smoke sampling system is required, means may be provided to isolate the smoke accumulators in such compartments for the system. Such means are to be to the satisfaction of the Society.

(2) Smoke accumulators are to be located for optimum performance and are to be spaced so that no part of the overhead deck area is more than 12 *m* measured horizontally from an accumulator. Where systems are used in spaces which may be mechanically ventilated, the position of the smoke accumulators is to be considered having regard to the effects of ventilation. At least one additional smoke accumulator is to be provided in the

upper part of each exhaust ventilation duct. An adequate filtering system is to be fitted at the additional accumulator to avoid dust contamination.

(3) Smoke accumulators are to be positioned where impact or physical damage is unlikely to occur.

(4) Sampling pipe networks are to be balanced to ensure compliance with the requirements of **30.2.2-4**. The number of accumulators connected to each sampling pipe is to ensure compliance with the requirements of **30.2.4-2(2)**.

(5) Smoke accumulators from more than one enclosed space are not to be connected to the same sampling point.

6) In cargo holds where non-gastight "tween deck panels" (movable stowage platforms) are provided, smoke accumulators are to be located in both the upper and lower parts of the holds

2. Sampling pipes

(1) The sampling pipe arrangements are to be such that the location of the fire can be readily identified.

(2) Sampling pipes are to be self-draining and suitably protected from impact or damage from cargo working.

30.2.4 System Control Requirements

1. Visual and audible fire signals

(1) The detection of smoke or other products of combustion is to initiate a visual and audible signal at the control panel and indicating units.

(2) The control panel is to be located on the navigating bridge or in the fire control station. An indicating unit is to be located on the navigation bridge if the control panel is located in the fire control station.

(3) Clear information is to be displayed on or adjacent to the control panel and indicating units designating the spaces covered.

(4) Power supplies necessary for the operation of the system are to be monitored for loss of power. Any loss of power is to initiate a visual and audible signal at the control panel and the navigating bridge which is to be distinct from a signal indicating smoke detection.

(5) Means to manually acknowledge all alarm and fault signals are to be provided at the control panel. The audible alarm sounders on the control panel and indicating units may be manually silenced. The control panel is to clearly distinguish between normal, alarm, acknowledged alarm, fault and silenced conditions.

(6) The system is to be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared.

2. Testing

(1) Suitable instructions and component spares are to be provided for the testing and maintenance of the system.

(2) After installation, the system is to be functionally tested using smoke generating machines or equivalent as a smoke source. An alarm is to be received at the control unit in not more than 180 *seconds* for vehicle decks, and not more than 300 *seconds* for container and general cargo holds, after smoke is introduced at the most remote accumulator.

Chapter 31 LOW LOCATION LIGHTING SYSTEMS

31.1 General

31.1.1 Application

This chapter details the specifications for low locations lighting systems as required by this Part.

31.2 Engineering Specifications

31.2.1 General Requirements

Any required low location lighting systems are to be approved by the Society.

Chapter 32 FIXED EMERGENCY FIRE PUMPS

32.1 General

32.1.1 Application

This chapter details the specifications for emergency fire pumps as required by this Part.

32.2 Engineering Specifications

32.2.1 General Requirements

The emergency fire pump is to be of a fixed independently driven power-operated pump.

32.2.2 Component Requirements

1. Capacity of the pump

The capacity of the pump is not to be less than 40% of the total capacity of the fire pumps required by **10.2.2-4(1)** and in any case not less than the follow:

(1) For ships of 2,000 *gross tonnages* and upwards, not less than 25 m^3/h

(2) For ships less than 2,000 gross tonnages, not less than 15 m^3/h

2. Pressure at hydrants

When the pump is delivering the quantity of water required by **-1** above, the pressure at any hydrants is to be not less than the minimum pressure required by the provisions of **10.2.1-6(1).**

3. Suction heads

The total suction head and the net positive suction head of the pump are to be determined having due regard to the other requirements of this Part and this Chapter on the pump capacity and on the hydrant pressure under all conditions of list, trim, roll and pitch likely to be encountered in service. The ballast condition of a ship on entering or leaving a dry dock need not be considered a service condition.

32.2.3 Diesel Engines and Fuel Tank

1. Starting of diesel engine

Any diesel driven power source for the pump is to be capable of being readily started in its cold condition down to the temperature of 0ºC by hand (manual) cracking. If this is impracticable, or if lower temperature are likely to be encountered, consideration is to be given to the provision and maintenance of heating arrangement, acceptable to the Society so that ready starting will be assured. If hand (manual) starting is impracticable, the Society may permit other means of starting. These means are to be such as to enable the diesel driven power source to be started at least 6 times within a period of 30 *minutes* and at least twice within the first 10 *minutes.*

2. Fuel tank capacity

Any service fuel tank is to contain sufficient fuel to enable the pump to run on full load for at least 3 **hours** and sufficient reserves of fuel are to be available outside the machinery space of category *A* to enable the pump to be run on full load for an additional 15 *hours*.

Chapter 33 ARRANGEMENT OF MEANS OF ESCAPE

33.1 General

33.1.1 Application

This chapter details the specifications for means of escapes as required by this Part.

33.2 Width and Inclination Angle of Means of Escape

33.2.1 Width and Inclination Angle of Stairways and Corridors

Stairways and corridors used as means of escape from control stations, accommodation and service spaces are to be not less than 700 *mm* in clear width and are to have a handrail on one side. Stairways and corridors with a clear width of 1,800 *mm* and over are to have handrails on both sides." Clear width" is considered the distance between the handrail and the bulkhead on the other side or between the handrails. The angle of inclination of stairways is to be, in general, 45 *degrees* but not greater than 50 *degrees*, and in machinery spaces and small spaces not more than 60 *degrees*. Doorways which give access to a stairway are to be of the same size as the stairway.

Chapter 34 FIXED DECK FOAM SYSTEMS

34.1 General

34.1.1 Application

This chapter details the specifications for fixed deck foam systems which are required to be provided by this Part.

34.2 Engineering Specifications

34.2.1 General Requirements

1. The arrangements for providing foam are to be capable of delivering foam to the entire cargo tanks deck area as well as into any cargo tank the deck of which has been ruptured.

2. The deck foam system is to be capable of simple and rapid operation.

3. Operation of a deck foam system at its required output is to permit the simultaneous use of the minimum required number of jets of water at the required pressure from the fire main.

34.2.2 Component Requirements

1. The rate of supply of foam solution is to be not less than the greatest of the following:

(1) 0.6 liters/minute per square meter of cargo tanks deck area, where cargo tanks deck area means the maximum breadth of the ship multiplied by the total longitudinal extent of the cargo tank spaces ;

(2) 6 liters/minute per square meter of the horizontal sectional area of the single tank having the largest such area; or

(3) 3 liters/minute per square meter of the area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1,250 *liters/minute*.

2. Sufficient foam concentrate is to be supplied to ensure at least 20 *minutes* of foam generation in tankers fitted with an inert gas installation or 30 *minutes* of foam generation in tankers not fitted with an inert gas installation when using solution rates stipulated in (**1**), (**2**) and (**3**) of **-1** above, whichever is the greatest. The foam expansion ratio (i.e., the ratio of the volume of foam produced to the volume of the mixture of water and foam-making concentrate supplied) is not generally to exceed 12 to 1. Where systems essentially produce low expansion foam but an expansion ratio slightly in excess of 12 to 1, the quantity of foam solution available is to be calculated as for 12 to 1 expansion ratio systems. When medium expansion ratio foam (between 50 to 1 and 150 to 1 expansion ratio) is employed, the application rate of the foam and the capacity of a monitor installation is to be to the satisfaction of the Society.

3. Foam from the fixed foam system is to be supplied by means of monitors and foam applicators. At least 50% of the foam solution supply rate required in (**1**) and (**2**) of **34.2.2-1** is to be delivered from each monitor. On tankers of less than 4,000 *tonnes deadweight*, installation of monitors but only applicators may not be required. However, in

such a case the capacity of each applicator is to be at least 25% of the foam solution supply rate required in (**1**) or (**2**) of **34.2.2-1**.

4. The capacity of any monitor is to be at least 3 *liters/minute* of foam solution per square meter of deck area protected by that monitor, such area being entirely forward of the monitor. Such capacity is to be not less than 1,250 *liters/minute*.

5. The capacity of any applicator is to be not less than 400 *liters/minute* and the applicator throw in still air conditions is to be not less than 15 *m*.

34.2.3 Installation Requirements

1. The main control station for the system is to be suitably located outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected.

2. Monitors

(1) The number and position of monitors is to be such as to comply with the requirements of **34.2.1-1**.

(2) The distance from the monitor to the farthest extremity of the protected area forward of that monitor is not to be more than 75% of the monitor throw in still air conditions.

(3) A monitor and hose connection for a foam applicator is to be situated both port and starboard at the front of the poop or accommodation spaces facing the cargo tanks deck. On tankers of less than 4,000 tonnes deadweight, a hose connection for a foam applicator is to be situated both port and starboard at the front of the poop or accommodation spaces facing the cargo tanks deck.

3. Applicators

(1) The number of foam applicators provided is to be not less than four. The number and disposition of foam main outlets are to be such that foam from at least two applicators can be directed on to any part of the cargo tanks deck area.

(2) Applicators are to be provided to ensure flexibility of action during fire-fighting operations and to cover areas screened from the monitors.

4. Isolation valves

Valves are to be provided in the foam main and in the fire main when this is an integral part of the deck foam system, immediately forward of any monitor position to isolate damaged sections of those mains.

Chapter 35 INERT GAS SYSTEMS

35.1 General

35.1.1 Application

This chapter details the specifications for inert gas systems as required by this Part.

35.2 Engineering Specifications

35.2.1 General Requirements

1. Throughout this chapter the term cargo tank includes also slop tanks.

2. The inert gas system referred to in this Part is to be designed, constructed and tested under the provisions of this Chapter. It is to be so designed and operated as to render and maintain the atmosphere of the cargo tanks non-flammable at all times, except when such tanks are required to be gas-free.

3. The system is to be capable of:

(1) Inerting empty cargo tanks by reducing the oxygen content of the atmosphere in each tank to a level at which combustion cannot be supported;

(2) Maintaining the atmosphere in any part of any cargo tank with an oxygen content not exceeding 8% by volume and at a positive pressure at all times in port and at sea except when it is necessary for such a tank to be gas-free;

(3) Eliminating the need for air to enter a tank during normal operations except when it is necessary for such a tank to be gas-free; and

(4) Purging empty cargo tanks of a hydrocarbon gas, so that subsequent gas-freeing operations will at no time create a flammable atmosphere within the tank.

4. Materials used in inert gas systems are to be suitable for their intended purpose. In particular those parts or scrubbers, blowers, non-return devices, scrubber effluent and other drain pipes which may be subject to corrosive action of the gases and/or liquids are to be either constructed of corrosion resistant material or lined with rubber, glass fibre epoxy resin or other equivalent coating material.

35.2.2 Supply of Inert Gas

1. The inert gas supply may be treated flue gas from main or auxiliary boilers. The Society may accept systems using flue gases from one or more separate gas generators or other sources or any combination thereof, provided that an equivalent standard of safety is achieved. Such systems are, as far as practicable, to comply with the requirements of this Chapter. Systems using stored carbon dioxide are not to be permitted unless the Society is satisfied that the risk of ignition from generation of static electricity by the system itself is minimized.

2. The system is to be capable of delivering inert gas to the cargo tanks at a rate of at least 125% of the maximum rate of discharge capacity of the ship expressed as a volume.

3. The system is to be capable of delivering inert gas with an oxygen content of not more than 5% by volume in the inert gas supply main to the cargo tanks at any required rate of flow.

4. Two fuel oil pumps are to be fitted to the inert gas generator. The Society may permit only one fuel oil pump on condition that sufficient spares for the fuel oil pump and its prime mover are carried on board to enable any failure of the fuel oil pump and its prime mover to be rectified by the ship's crew.

5. Arrangements are to be made to vent the inert gas from inert gas generators to the atmosphere when the inert gas produced is off-specification, e.g. during starting-up or in the event of equipment failure.

6. Automatic combustion control capable of producing suitable inert gas under all service conditions is to be fitted to the inert gas generators.

35.2.3 Scrubbers

1. A flue gas scrubber is to be fitted which will effectively cool the volume of gas specified in **-2** and **-3** of **35.2.2** and remove solids and sulphur combustion products. The cooling water arrangements are to be such that an adequate supply of water will always be available without interfering with any essential services on the ship. Provision is to also be made for an alternative supply of cooling water.

2. Filters or equivalent devices are to be fitted to minimize the amount of water carried over to the inert gas blowers.

3. The scrubber is to be located aft of all cargo tanks, cargo pump-rooms and cofferdams separating these spaces from machinery spaces of category *A*.

35.2.4 Blowers

1. At least two blowers are to be fitted which are together to be capable of delivering to the cargo tanks at least the volume of gas required by **-2** and **-3** of **35.2.2**. When two blowers are provided, the total required capacity of the inert gas system is preferably to be divided equally between the two blowers, and in no case is one blower to have a capacity less than 1/3 of the total capacity required by **35.2.2-2**. In the system with gas generator the Society may permit only one blower if that system is capable of delivering the total volume of gas required by **-2** and **-3** of **35.2.2** to the protected cargo tanks, provided that sufficient spares for the blower and its prime mover are carried on board to enable any failure of the blower and its prime mover to be rectified by the ship's crew.

2. The inert gas system is to be so designed that the maximum pressure which it can exert on any cargo tank will not exceed the test pressure of any cargo tank. Suitable shutoff arrangements are to be provided on the suction and discharge connections of each blower. Arrangements are to be provided to enable the functioning of the inert gas plant to be stabilized before commencing cargo discharge. If the blowers are to be used for gas-freeing, their air inlets are to be provided with blanking arrangements.

3. The blowers are to be located aft of all cargo tanks, cargo pump-rooms and cofferdams separating these spaces from machinery spaces of category *A*.

35.2.5 Water Seals

1. The water seal referred to in **35.2.6-4(1)** is to be capable of being supplied by two separate pumps, each of which is to be capable of maintaining an adequate supply at all times.

2. The arrangement of the seal and its associated fittings is to be such that it will prevent backflow of hydrocarbon vapours and will ensure the proper functioning of the seal under operating conditions.

3. Provision is to be made to ensure that the water seal is protected against freezing, in such a way that the integrity of seal is not impaired by overheating.

4. A water loop or other approved arrangement is also to be fitted to each associated water supply and drain pipe and each venting or pressure-sensing pipe leading to gas safe spaces. (Gas safe space means a space in which the entry of hydrocarbon vapours would produce hazards with regard to flammability or toxicity. The same is referred hereinafter in this Chapter.) Means are to be provided to prevent such loops from being emptied by vacuum.

5. The deck water seal and loop arrangements are to be capable of preventing return of hydrocarbon vapours at a pressure equal to the test pressure of the cargo tanks.

6. In respect of **35.2.10-1(7),** safety measures are to be taken for the maintenance of an adequate reserve of water at all times and the integrity of the arrangements to permit the automatic formation of the water seal when the gas flow ceases. The audible and visual alarm on the low level of water in the water seal is to operate when the inert gas is not being supplied.

35.2.6 Safety Measures in the System

1. Flue gas isolating valves

(1) Flue gas isolating valves are to be fitted in the inert gas supply mains between the boiler uptakes and the flue gas scrubber.

(2) These valves are to be provided with indicators to show whether they are open or shut, and precautions are to be taken to maintain them gas-tight and keep the seatings clear of soot.

(3) Arrangements are to be made to ensure that boiler soot blowers cannot be operated when the corresponding flue gas valve is open.

2. Prevention of flue gas leakage

(1) Special consideration is to be given to the design and location of scrubber and blowers with relevant piping and fittings in order to prevent flue gas leakages into enclosed spaces.

(2) To permit safe maintenance, an additional water seal or other effective means of preventing flue gas leakage is to be fitted between the flue gas isolating valves and scrubber or incorporated in the gas entry to the scrubber.

3. Gas regulation valves

(1) A gas regulating valve is to be fitted in the inert gas supply main. This valve is to be automatically controlled to close as required in **-5** below. It is also to be capable of automatically regulating the flow of inert gas to the

cargo tanks unless means are provided to automatically control the speed of the inert gas blowers required in 35.2.4.

(2) The valve referred to in **(1)** above is to be located at the forward bulkhead of the forward most gas-safe space through which the inert gas supply main passes.

4. Non-return devices of flue gas

(1) At least two non-return devices, one of which is to be a water seal, are to be fitted in the inert gas supply main, in order to prevent the return of hydrocarbon vapour to the machinery space uptakes or to any gas-safe spaces under all normal conditions of trim, list and motion of the ship. They are to be located between the automatic valve required by **-3** above and the aftermost connection to any cargo tank or cargo pipeline.

(2) The devices referred to in **(1)** above are to be located in the cargo area on deck.

(3) The device referred to in (**1**) above as a device other than a water seal is to be a non-return valve or equivalent capable of preventing the return of vapours or liquids and fitted forward of the deck water seal required in (1) above. It is to be provided with positive means of closure. As an alternative to positive means of closure, an additional valve having such means of closure may be provided forward of the non-return valve to isolate the deck water seal from the inert gas main to the cargo tanks.

(4) As an additional safeguard against the possible leakage of hydrocarbon liquids or vapours back from the deck main, means are to be provided to permit this section of the line between the valve having positive means of closure referred to in (**3**) above and the valve referred to in **-3** above to be vented in a safe manner when the first of these valves is closed.

5. Automatic shutdown

(1) Automatic shutdown of the inert gas blowers and gas regulating valve is to be arranged on predetermined limits being reached in respect of (**1**), (**2**) and (**3**) of 35.2.10-1.

(2) Automatic shutdown of the gas regulating valve is to be arranged in respect of 35.2.10-1(4)**.** In the system with a separate inert gas generator, automatic shutdown of the gas regulating valve is also to be arranged in respect of 35.2.10-2(2)**.**

(3) For a separate inert gas generator, automatic shutdown of the oil fuel supply is to be arranged on predetermined limits being reached in respect of (**1**) and (**3**) of 35.2.10-1.

6. In respect of 35.2.10-1(5), when the oxygen content of the inert gas exceeds 8% by volume, immediate action is to be taken to improve the gas quality. Unless the quality of the gas improves, all cargo tank operations are to be suspended so as to avoid air being drawn into the tanks and the isolation valve referred to in **-4**(**3**) above is to be closed.

35.2.7 Inert Gas Lines

1. The inert gas main may be divided into two or more branches forward of the non-return devices required by 35.2.5 and 35.2.6-4.

2. The inert gas supply main is to be fitted with branch piping leading to each cargo tank. Branch piping for inert gas is to be fitted with either stop valves or equivalent means of control for isolating each tank. Where stop valves

are fitted, they are to be provided with locking arrangements, which is to be under the control of a responsible ship's officer. The control system operated is to provide unambiguous information of the operational status of such valves.

3. In combination carriers, the arrangement to isolate the slop tanks containing oil or oil residues from other tanks is to consist of blank flanges which will remain in position at all times when cargoes other than oil are being carried except where deemed as appropriately by the Society.

4. Means are to be provided to protect cargo tanks against the effect of overpressure or vacuum caused by thermal variations when the cargo tanks are isolated from the inert gas mains.

5. Piping systems are to be so designed as to prevent the accumulation of cargo or water in the pipelines under all normal conditions.

6. Arrangements are to be provided to enable the inert gas main to be connected to an external supply of inert gas. The arrangements are to consist of a 250 *mm* nominal pipe size bolted flange, isolated from the inert gas main by a valve and located forward of the non-return valve referred to in **35.2.6-4(3).** The design of the flange is to conform to the appropriate class in the standards adopted for the design of other external connections in the ship's cargo piping system.

7. If a connection is fitted between the inert gas supply mains and the cargo piping system, arrangements are to be made to ensure an effective isolation having regard to the large pressure difference which may exist between the systems. This is to consist of two shutoff valves with an arrangement to vent the space between the valves in a safe manner or an arrangement consisting of a spool-piece with associated blanks.

8. The valve separating the inert gas supply main from the cargo main and which is on the cargo main side is to be a non-return valve with a positive means of closure.

35.2.8 Indication Devices

Means are to be provided for continuously indicating the temperature and pressure of the inert gas at the discharge side of the gas blowers, whenever the gas blowers are operating.

35.2.9 Indicating and Recording Devices

1. Instrumentation is to be fitted for continuously indicating and permanently recording, when the inert gas is being supplied:

(1) The pressure of the inert gas supply mains forward of the non-return devices required by **35.2.6-4(1); and**

(2) The oxygen content of the inert gas in the inert gas supply mains on the discharge side of the gas blowers.

2. The devices referred to in **-1** above are to be placed in the cargo control room where provided. But where no cargo control room is provided, they are to be placed in a position easily accessible to the officer in charge of cargo operations.

3. In addition, meters are to be fitted:

(1) in the navigating bridge to indicate at all times the pressure referred to in **-1(1)** above and the pressure in the slop tanks of combination carriers, whenever those tanks are isolated from the inert gas supply main; and

(2) in the machinery control room or in the machinery space to indicate the oxygen content referred to in **-1**(**2**) above.

4. At least each 2 sets of portable instruments for measuring oxygen and flammable vapour concentration are to be provided. The portable instruments for flammable vapour concentrations are to be capable of measurement in an inerted atmosphere. In addition, suitable arrangement is to be made on each cargo tank such that the condition of the tank atmosphere can be determined using these portable instruments.

5. Suitable means are to be provided for the zero and span calibration of both fixed and portable gas concentration measurement instruments, referred to in **-4** above.

35.2.10 Audible and Visual Alarms

1. For inert gas systems of both the flue gas type and the inert gas generator type, audible and visual alarms are to be provided to indicate:

(1) Low water pressure or low water flow rate to the flue gas scrubber as referred to in **35.2.3-1**;

(2) High water level in the flue gas scrubber as referred to in **35.2.3-1**;

(3) High gas temperature as referred to in **35.2.8**;

(4) Failure of the inert gas blowers referred to in **35.2.4**;

(5) Oxygen content in excess of 8% by volume as referred to in **35.2.9-1(1);**

(6) Failure of the power supply to the automatic control system for the gas regulating valve and to the indicating devices as referred to in **35.2.6-3** and **35.2.9-1**;

(7) Low water level in the water seal as referred to in **35.2.6-4(1);**

(8) Gas pressure less than 100 *mm* water gauge as referred to in **35.2.9-1(1);** The alarm arrangement is to be such as to ensure that the pressure in slop tanks in combination carriers can be monitored at all times; and

(9) High gas pressure as referred to in **35.2.9-1(1).**

2. For inert gas systems of the inert gas generator type, additional audible and visual alarms are to be provided to indicate:

(1) Insufficient fuel oil supply;

(2) Failure of the power supply to the generator; and

(3) Failure of the power supply to the automatic control system for the generator.

3. The alarms required in (**5**), (**6**) and **(8**) of **-1** above are to be fitted in the machinery space and cargo control room, where provided, but in each case in such a position that they are immediately received by responsible members of the crew.

4. An audible alarm system independent of that required in **-1**(**8**) above or automatic shutdown of cargo pumps is to be provided to operate on predetermined limits of low pressure in the inert gas main being reached.

5. Automatic stoppage of cooling water supply to the scrubber is to be arranged in respect of **-1(2)** above.

35.2.11 Instruction Manuals

Detailed instruction manuals are to be provided on board, covering the operations, safety and maintenance requirements and occupational health hazards relevant to the inert gas system and its application to the cargo tank system. The manuals are to include guidance on procedures to be followed in the event of a fault or failure of the inert gas system.

Chapter 36 FIXED HYDROCARBON GAS DETECTION SYSTEMS

36.1 General

36.1.1 Application

This chapter details the specifications for fixed hydrocarbon gas detection systems which are required to be provided by **4.5.7** of this Part

36.2 Engineering Specifications

36.2.1 General Requirements

1. The fixed hydrocarbon gas detection systems required to be provided by this chapter are to be approved by the Society.

2. The system is to be comprised of a central unit for gas measurement and analysis and gas sampling pipes in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks.

3. The system may be integrated with the cargo pump-room gas detection system, provided that the spaces referred to in paragraph **(2)** above are sampled at the rate required in **36.2.2-3(1).** Continuous sampling from other locations may also be considered provided the sampling rate is complied with.

36.2.2 Component Requirements

1. Gas Sampling Lines

(1) Common sampling lines to the detection equipment are not to be fitted, except the lines serving each pair of sampling points as required in under **(3).**

(2) The materials of construction and the dimensions of gas sampling lines are to be such as to prevent restriction. Where non-metallic materials are used, they are to be electrically conductive. The gas sampling lines are not to be made of aluminium.

(3) The configuration of gas sampling lines is to be adapted to the design and size of each space. Except as provided in under **(4)** and **(5)**, the sampling system is to allow for a minimum of two hydrocarbon gas sampling points, one located on the lower and one on the upper part where sampling is required. When required, the upper gas sampling point is not to be located lower than 1m from the tank top. The position of the lower located gas sampling point is to be above the height of the girder of bottom shell plating but at least 0.5*m* from the bottom of the tank and it is to be provided with means to be closed when clogged. In positioning the fixed sampling points, due regard is also to be given to the density of vapours of the oil products intended to be transported and the dilution from space purging of ventilation.

(4) For ships with deadweight of less than 50,000 *tonnes*, the Society may allow the installation of one sampling location for each tank for practical and/or operational reasons.

(5) For ballast tanks in the double-bottom, ballast tanks not intended to be partially filled and void spaces, the upper gas sampling point is not required.

(6) Means are to be provided to prevent gas sampling lines from clogging when tanks are ballasted by using compressed air flushing to clean the line after switching from ballast to cargo loaded mode. The system is to have an alarm to indicate if the gas sampling lines are clogged.

2. Gas Analysis Unit

(1) The gas analysis unit is to be located in a safe space and may be located in areas outside the ship's cargo area; for example, in the cargo control room and/or navigation bridge in addition to the hydraulic room when mounted on the forward bulkhead, provided the following requirements are observed:

(a) Sampling lines are not to run through gas safe spaces, except where permitted under **(e)**;

(b) The hydrocarbon gas sampling pipes are be to equipped with flame arresters. Sample hydrocarbon gas is to be led to the atmosphere with outlets arranged in a safe location, not close to a source of ignitions and not close to the accommodation area air intakes;

(c) A manual isolating valve, which is to be easily accessible for operation and maintenance, is to be fitted in each of the sampling lines at the bulkhead on the gas safe side;

(d) The hydrocarbon gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc., is to be located in a reasonably gas-tight cabinet (e.g., fully enclosed steel cabinet with a door with gaskets) which is to be monitored by its own sampling point. At a gas concentration above 30% of the lower flammable limit inside the steel enclosure the entire gas analyzing unit is to be automatically shut down; and

(e) Where the enclosure cannot be arranged directly on the bulkhead, sample pipes are to be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and analyzing unit, and are to be routed on their shortest ways.

3. Gas Detection Equipment

(1) The gas detection equipment is to be designed to sample and analyze from each sampling line of each protected space, sequentially at intervals not exceeding 30 *min*.

(2) Means are to be provided to enable measurements with portable instruments, in case the fixed system is out of order or for system calibration. In case the system is out of order, procedures are to be in place to continue to monitor the atmosphere with portable instruments and to record the measurement results.

(3) Audible and visual alarms are to be initiated in the cargo control room, Navigation Bridge and at the analysing unit when the vapour concentration in a given space reaches a pre-set value, which is not to be higher than the equivalent of 30% of the lower flammable limit.

(4) The gas detection equipment is to be so designed that it may readily be tested and calibrated.