Contents

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part R FIRE PROTECTION, DETECTION AND EXTINCTION

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 **Part N** and **Part S**, 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**.

5 Accumulator battery systems consisting of lithium-ion batteries with total capacities of 20 *kWh* or more, and associated equipment are to also be in accordance with **1.2.3, Annex 2.11.1-2, Part H**.

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 60℃ (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 **Part N** and **Part S**, as appropriate.

2 A liquid cargo with a flashpoint of less than 60℃ 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 **Part S**, 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 37.8℃ is to be considered to be a cargo introducing additional fire hazards. Ships carrying such substances are to comply with **15.14** of **Part S**. When ships operate in restricted areas and at restricted times, the Society may agree to waive requirements for refrigeration systems in **15.14.3** of **Part S**.

1.2.3 Liquid Cargoes with a Flashpoint above 60℃

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

2 Tankers carrying liquid cargoes with a flashpoint above 60℃ (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 Part 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 ship's design and arrangements, as a whole, comply with the relevant prescriptive requirements in **Chapters 4** to **20** (except **Chapter 17**);

(2) the ship's design and arrangements, as a whole, have been reviewed and approved in accordance with **Chapter 17**; or

(3) part(s) of the ship's 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 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature, within the time listed below:

class "*A* - 60" 60 *minutes*

class "*A* - 30" 30 *minutes*

class "*A* - 15" 15 *minutes*

class "*A* - 0" 0 *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 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225°C above the original temperature, within the time listed below:

class "*B* - 15" 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 **Chapter 17** of **Part S**.

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 ship's radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment is centralized. Spaces where the fire recording or fire control equipment is centralized are also considered to be a *fire control station*.

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, Regulation 1.1 of the International Convention for Safety of Life at Sea 1974 (hereinafter, referred to as "*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, 2010 (2010 *FTP* Code) as adopted by the *MSC* of the *IMO* by resolution *MSC*.307(88), 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 **Chapter 19** of **Part N**.

3.2.26 Helideck

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

3.2.27 Helicopter Facility

Helicopter facility is a helideck 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 750°C, 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 deckhead 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 deckhead 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, for the purpose of Chapter II-2, Regulation 9 of the *SOLAS*, 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 80-120°C where the heat is provided by a hot surface (*e.g.* by an electrically-heated oven). The hot room may also include the space where the oven is located and adjacent bathrooms.

3.2.45 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 Safety Centre

Safety centre is a control station dedicated to the management of emergency situations. Safety systems' operation, control and/or monitoring are an integral part of the safety centre.

3.2.52 Cabin Balcony

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

3.2.53 Fire Damper

Fire damper is, for the purpose of 9.7, 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 restrict the passage of fire. Fire dampers are classified as follows:

(1) *Automatic fire damper* is a 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 through a control located at a distance away from the controlled damper.

3.2.54 Vehicle Carrier*

Vehicle carrier is a cargo ship which only carries cargo in ro-ro spaces or vehicle spaces, and which is designed for the carriage

of unoccupied motor vehicles without cargo, as cargo.

3.2.55 Helicopter Landing Area

Helicopter landing area is an area on a ship designated for occasional or emergency landing of helicopters but not designed for routine helicopter operations.

3.2.56 Winching Area

Winching area is a pick-up area provided for the transfer by helicopter of personnel or stores to or from the ship, while the helicopter hovers above the deck.

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 D** 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 60°C is to be used;

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

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

(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) In ships, to which the requirements of **Part GF** are not applicable, the use of fuel having a lower flashpoint than otherwise specified in **(1)** above, 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) In ships, to which the requirements of **Part GF** are applicable, the use of oil fuel having a lower flashpoint than otherwise specified in **(1)** above is permitted.

(6) Fuel oil is not to be heated to the temperature within 10°C 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 60°C. In general, the use of free-standing oil fuel tanks are 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 nor 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 material approved by the Society, 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 D**. Use of ordinary cast iron valves in piping systems is to comply with the requirements of **12.1.5 of Part D**.

(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 onto 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.

(9) The upper ends of sounding pipes for fuel overflow tanks which terminate in machinery spaces are to be fitted with self-closing blanking devices and with small-diameter self-closing control cocks located below the blanking devices for the purpose of ascertaining before the blanking devices are 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 cocks involves no ignition hazard.

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 Equipments*

Gas welding equipments 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 and Location of Fuel Tanks*

1 Cargo pump-rooms, cargo tanks, slop tanks and cofferdams are to be positioned forward of machinery spaces. However, oil fuel bunker 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 ship's 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.

8 In cases where fuel tanks are located in the cargo area of the oil tankers defined in **2.1.1(6), Part 1 of the Rules for Marine Pollution Prevention Systems**, the following **(1)** to **(5)** are to apply. The "cargo tank block" referred to in the following **(1)** and **(2)** means the part of the ship extending from the aft bulkhead of the aft most cargo or slop tank to the forward bulkhead of the forward most cargo or slop tank, extending to the full depth and beam of the ship, but not including the area above the deck of the cargo or slop tank.

(1) Fuel tanks located with a common boundary to cargo or slop tanks are not to be situated within nor extend partly into the cargo tank block.

(2) Fuel tanks specified in **(1)** above may be situated aft and/or forward of the cargo tank block.

(3) Fuel tanks may be accepted when located as independent tanks on open deck in the cargo area subject to spill and fire safety considerations.

(4) The arrangement of independent fuel tanks and associated fuel piping systems, including the pumps, can be as for fuel tanks and associated fuel piping systems located in the machinery spaces.

(5) For electrical equipment, the requirements to hazardous area classification specified in **Part H** are to be met.

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 **2.2.2, Part 1, Part C** and, in addition, with the following. For the application of **2.2.2, Part 1, Part C**, 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)**. Any isolation is to also continue to permit the passage of large volumes of vapour, air or inert gas mixtures during cargo loading and ballasting, or during discharging in accordance with **11.6.1(2)**.

(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 when carrying cargoes described in 1.2.1 or 1.2.2, 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** through **-8**.

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 **Chapters 17** and **18** of **Part S**, 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's arrangement and equipment, accept other fixed installations, in accordance with **1.1.2** and **-8**.

7 For tankers 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 in accordance with **1.1.2** and **-8**.

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 Inert 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 least one portable instrument for measuring flammable vapour concentrations and at least one portable instrument for measuring oxygen concentrations, together with a sufficient set of spares. These measuring instruments are to satisfy the following **(a)** to **(c)**:

(a) Suitable means are to be provided for the calibration of such instruments.

(b) Measuring instruments are to be deemed appropriate by the Society.

(c) Portable instruments for measuring flammable vapour concentrations can be measured such concentrations in air (% LEL).

(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, Part R of the Rules** 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 inerting systems for such spaces need not be equipped with fixed hydrocarbon gas detection equipment.

(c) Notwithstanding the above, cargo pump-rooms subject to the provisions of **4.5.10, Part R of the Rules** 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 fire fighting 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 I*C* 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 II*C* or III*C* 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;

(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 defined in **Chapter 1** of the **Rules for Automatic and Remote Control Systems**; and

(c) centralized control stations for main propulsion defined in **Chapter 1** of the **Rules for Automatic and Remote Control Systems**, 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 **7.4.1-1.(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 specially 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 spaces which can not be readily accessed 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*

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 R9.1**.

(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 R9.1**.

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 R9.1** and **R9.2** 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 R9.1** and **R9.2**. 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 ship's radio equipment

Fire control stations

Control room for propulsion machinery when located outside the machinery space

Spaces containing centralized fire alarm equipment

(2) Corridors

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 R9.1 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)											*A*-30

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 sidescuttles 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 R9.2 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)	*	*	*	*	*	*	*	*	*	-	*A*-0
Ro-ro and vehicle spaces	(11)	*A*-60	*A*-30	*A*-30	*A*-30	*A*-0	*A*-60	*A*-0	*A*-0	*A*-30	*A*-0	*A*-30

Note: To be applied to **Tables R9.1** and **R9.2** 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 (Deleted)

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 I*C* 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 R9.3** and **R9.4** 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 R9.3** and **R9.4**. 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

Spaces containing emergency sources of power and lighting

Wheelhouse and chartroom

Spaces containing the ship's radio equipment

Fire control stations

Control room for propulsion machinery when located outside the machinery space

Spaces containing centralized fire alarm equipment

(2) Corridors

Corridors and lobbies

(3) Accommodation spaces

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 R9.3 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 Spaces	(7)							*A*-0[b]	*A*-0	*A*-0	*
Cargo pump rooms	(8)								*	*A*-60	*
Service spaces (high risk)	(9)									*A*-0[b]	*
Open decks	(10)										-

Table R9.4 Fire Integrity of Decks Separating Adjacent Spaces (For Tankers)

Spaces below ↓	Spaces above →	(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 R9.3** and **R9.4** 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 outside diameters of 150 *mm* or more and not less than 600 *mm* for pipe outside 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 950°C for "*A*-0" and 850°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 approved as "*A*" class without the sill being part of the frame are to be installed such that the gap under the door does not exceed 12 *mm* and a non-combustible sill is to be installed under the door such that floor coverings do not extend beneath the closed door. Doors approved as "*B*" class without the sill being part of the frame are to be installed such that the gap under the door does not exceed 25 *mm*. 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°C, 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 single and double wall ducts, are to be of steel or equivalent material except flexible bellows of short length not exceeding 600 *mm* used for connecting fans to the ducting in air-conditioning rooms. 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 of steel or equivalent material, subject to the following conditions:

(1) The ducts are to be made of non-combustible material, which may be faced internally and externally with membranes having

low flame-spread characteristics and, in each case, a calorific value not exceeding 45 MJ/m^2 of their surface area for 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 ducts 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 dampers are to be easily accessible. Where they are placed behind ceilings or linings, these ceilings or linings are to be provided with an inspection hatch on which 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 be provided 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 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 the operating position of the closing device.

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

7 Ventilation openings 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. However, the galley ventilation systems on cargo ships of less than 4,000 *gross tonnage*, need not be completely separated from other ventilation systems, but may be served by separate ducts from a ventilation unit serving other spaces. In such a case, an automatic fire damper is to be fitted in the galley ventilation duct near the ventilation unit.

2 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 **-4** below.

3 Ducts provided for the ventilation of 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 **-4** below.

4 As permitted by **-2** and **-3** above, ducts are to 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* for ducts with a free cross-sectional area of less than 0.075 m^2, at least 4 *mm* for ducts with a free cross-sectional area of between 0.075 m^2 and 0.45 m^2, and at least 5 *mm* for ducts with a free cross-sectional area of over 0.45 m^2;

(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 boundaries of the spaces they serve 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 spaces they pass through.

5 For the purposes of **9.7.2-4(1)(d)** and **9.7.2-4(2)(b)**, ducts are to be insulated over their entire cross-sectional external surface. Ducts that are outside but adjacent to the specified space, and share one or more surfaces with it, are to be considered to pass through the specified space, and are to be insulated over the surface they share with the space for a distance of 450 *mm* past the duct.

6 Where it is necessary that a ventilation duct passes through a main vertical zone division, an automatic fire damper is to be fitted adjacent to the division. The damper is also to be capable of being manually closed from each side of the division. The control

location is to be readily accessible and be clearly and prominently marked. The duct between the division and the damper is to be constructed of steel in accordance with **9.7.2-4(1)(a)** and **(b)** and insulated to at least the same fire integrity as the division penetrated. The damper is to be fitted on at least one side of the division with a visible indicator showing the operating position of the damper.

9.7.3 Details of Fire Dampers and Duct Penetrations*

1 Ducts 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, wholly 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 0.075 m^2, pass through "*A*" class divisions, the openings are to be lined with a steel sheet sleeves. 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 divisions 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 that pass through "*A*" class divisions. Each damper is to be fitted close to the division penetrated and the duct between the damper and the division penetrated is to be constructed of steel in accordance with **9.7.2-4(1)(a)** and **9.7.2-4(1)(b)**. The fire damper is to operate automatically, but is also to be capable of being closed manually from both sides of the division. The damper is to be fitted with a visible indicator which shows the operating position of the damper. 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 penetaration of an "*A*" class division and then recombined into 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*

When passing through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges are to be constructed in accordance with **9.7.2-4(1)(a)** and **9.7.2-4(1)(b)**. Each exhaust duct is to be fitted with:

(1) a grease trap readily removable for cleaning;

(2) an automatically and remotely operated fire damper located in the lower end of the duct at the junction between the duct and the galley range hood and, in addition, a remotely operated fire damper in the upper end of the duct close to the outlet of the duct;

(3) arrangements, operable from within the galley, for shutting off the exhaust and supply 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 a "*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 fire fighting. 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:

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

(b) 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 connection

(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 tonnage*, 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 not be contiguous to the boundaries of machinery spaces of category *A* or those spaces containing main fire pumps. Where this 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 D 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 tonnage*, 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 tonnage* 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 R9.1** to **R9.4**, 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*, or boilers protected by fixed water-based local application fire-extinguishing systems as required by **10.5.5** , 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 **10.5.1-1(1)** to **(3)** 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 tonnage* 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 fire fighting 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;

(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 II*C* 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 labelled 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; and

(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 ship's 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.

10.10.4 Fire-fighter's Communication

A minimum of two two-way portable radiotelephone apparatus for each fire party for fire-fighter's communication is to be carried on board. Those two-way portable radiotelephone apparatus are to be of an explosion-proof type or intrinsically safe.

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 R9.1** to **R9.4**. 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℃ 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*" and "*B*" class divisions to ensure:

(a) that for such members supporting lifeboat and liferaft areas and "*A*" class divisions, the temperature rise limitation specified in **(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 R9.1** to **R9.4**, 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 comply with the following **(1)** and **(2)**, and are to be arranged in accordance with regulation **4.5.3-4(1)**.

(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 D 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)**. In addition, the secondary means are to be capable of preventing over-pressure or under-pressure in the event of damage to, or inadvertent closing of, the means of isolation required in **4.5.3-2(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 also to 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 were 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 NOTIFICATION 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 regulation III/6.4.2 of *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 athwartship supply corridors, may be permitted, provided such dead-end corridors are separated from crew accommodation areas and are inaccessible from passenger accommodation areas. Also, a part of a corridor that has a depth not exceeding its width is considered a recess or local extension and is permitted.

3 All stairways in accommodation and service spaces and control stations 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 protected enclosure. The ladder is to be fixed in such a way that heat is not transferred into the protected enclosure through non-insulated fixing points. The protected 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 a protected enclosure listed in **13.4.1(1)**. 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.

13.4.3 Escape from Machinery Spaces other than Those of Category *A**

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.

13.4.4 Inclined Ladders and Stairways

All inclined ladders/stairways fitted to comply with **13.4.1** with open treads in machinery spaces being part of or providing access to escape routes but not located within a protected 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 crews 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 as amended, including the amendments by *MSC*.1/*Circ*.1516) 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 ship's 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 ship's 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.

15.2.3 Means of Recharging Breathing Apparatus Cylinders and Spare Cylinders*

An onboard means of recharging breathing apparatus cylinders used during drills is to be provided or a suitable number of spare cylinders is to be carried on board to replace those used.

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 International Bulk Chemical Code (*IBC* Code), the International Gas Carrier Code (*IGC* Code) 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 to improve the gas quality. Unless the quality of the 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 be 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 be 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 **20A** 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 (including amendments approved as *MSC/Circ.*1552), 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) helideck 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) refuelling 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*

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

2 Where helicopters land or conduct winching operations on an occasional or emergency basis on ships without helidecks, fire-fighting equipment fitted in accordance with the requirements in **Chapter 10** may be used. This equipment is to be made readily available in close proximity to the landing or winching areas during helicopter operations.

3 Notwithstanding **-2** above, ships constructed on or after 1 January 2020, having a helicopter landing area, are to be provided with foam firefighting appliances which comply with **Chapter 37**.

18.3 Structure

18.3.1 Construction of Steel or Other Equivalent Material*

In general, the construction of the helidecks is to be of steel or other equivalent materials. If the helideck 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 helideck 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 helideck.

18.5 Fire-fighting

18.5.1 Fire-fighting Appliances*

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

(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 consisting of monitors or foam making branch pipes capable of delivering foam to all parts of the helideck in all weather conditions in which helicopters can operate. The system is to be capable of delivering a discharge rate as required in **Table R18.1** 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 helideck;

(6) in lieu of the above **(3)** to **(5)**, on ships constructed on or after 1 January 2020 having a helideck, foam firefighting appliances which comply with **Chapter 37**.

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

(8) 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 R18.1 Foam Discharge Rates

Category	Helicopter overall length	Discharge rate of foam solution (*l/minute*)
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 helidecks 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 a 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 ship's 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 and excepted 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 R19.1** and **R19.2**:

(1) Weather deck cargo spaces (includes the following **(2)** to **(6)** where applicable);

(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* 1.4*S* 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 substances having a flashpoint of less than 23℃ and in *Class* 3 as defined in the *IMDG* Code.

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

(9) Flammable solid substances in *Class* 4.1 as defined in the *IMDG* Code.

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

(11) Liquid 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) liquid substances having a flashpoint of less than 23℃ and in *Class* 6.1 as defined in the *IMDG* Code.

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

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

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

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

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

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

(22) Corrosive solid substances 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 R19.1**, **R19.2** and **R19.3** 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 R19.1 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 R19.1** 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 R19.1**, it means that such requirements are to be applied to all categories of dangerous goods as given in the corresponding line of **Table R19.3**, except as indicated in the notes below.
3. Subscripts in **Table R19.1** are as follows.
   a : For *Classes* 4 and 5.1 solids (**19.2.3(9), (10), (12)** and **(13)**) not applicable to closed 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 per hour. For *Classes* 4 and 5.1 liquids (**19.2.3(9)** to **(11)** and **(13)**) when carried in closed 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 R19.2 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 R19.2** 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 R19.2**, it means that this special requirement for the dangerous goods is applicable.
3. Subscripts in **Table R19.2** 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 sufficien

Table R19.3 Application of the Requirements to Different Classes of Dangerous Goodsexcept 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*	3*L*	3*M*	4.1	4.2	4.3 *liquids* [j]	4.3	5.1	5.2[e]	6.1*L* *liquids*	6.1*M* *liquids*	6.1*H* *liquids*	6.1	8*L* *liquids*	8*M* *liquids*	8*H* *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	-	-	-
19.3.8	X[b]	-	X	X	X	X	X	X	X	X	X	X	X[c]	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 R19.3** 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)**)

1.4*S* : Explosives in *Class* 1.4*S* (**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* : Flammable poisonous (toxic) high-pressure gases in *Class* 2.3 (**19.2.3(5)**)

2.3*NF*: Non-flammable poisonous (toxic) high-pressure gases in *Class* 2.3 (**19.2.3(6)**)

3*L* : Flammable liquid substances having a flashpoint of less than 23℃ in *Class* 3 (**19.2.3(7)**)

3*M* : Flammable liquid substances having a flashpoint of 23℃ or above and less than or equal to 60℃ in *Class* 3 (**19.2.3(8)**)

4.1 : Flammable solid substances 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) liquid substances having a flashpoint of less than 23℃ in *Class* 6.1 Code. (**19.2.3(15)**)

6.1*M liquids* : Poisonous (toxic) liquid substances having a flashpoint of 23℃ or above and less than or equal 60℃ in *Class* 6.1 Code. (**19.2.3(16)**)

6.1*H liquids* : Poisonous (toxic) liquid substances having a flashpoint of greater than 60℃ in *Class* 6.1 Code. (**19.2.3(17)**)

6.1 : Poisonous (toxic) solid substances in *Class* 6.1 (**19.2.3(18)**)

8*L liquids* : Corrosive liquid substances having a flashpoint of less than 23℃ in *Class* 8 Code. (**19.2.3(19)**)

8*M liquids* : Corrosive liquid substances having a flashpoint of 23℃ or above and less than or equal 60℃ in *Class* 8 Code. (**19.2.3(20)**)

8*H liquids* : Corrosive liquid substances having a flashpoint of greater than 60℃ in *Class* 8 Code. (**19.2.3(21)**)

8 : Corrosive solid substances in *Class* 8 (**19.2.3(22)**)

9 : Miscellaneous dangerous substances in *Class* 9 (**19.2.3(23)**)

2. Whenever "X" appears in **Table R19.2**, it means that this special requirement for the dangerous goods is applicable.

3. Subscripts in **Table R19.3** 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 23℃ 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 23℃ under deck or in enclosed ro-ro spaces is prohibite

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 Arrangement*

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. Protective clothing is to be selected taking into account the hazards associated with the chemicals being transported.

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*

1 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.

2 On all ships, vehicles with fuel in their tanks for their own propulsion may be carried in cargo spaces other than vehicle or ro-ro spaces, provided that all the following conditions are met:

(1) the vehicles do not use their own propulsion within the cargo spaces;

(2) the cargo spaces are in compliance with the appropriate requirements of **Chapter 19**; and

(3) the vehicles are carried in accordance with the *IMDG* Code, as defined in regulation VII/1.1 of *SOLAS*.

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 and give at least the number of air changes required in **-1** above whenever vehicles are on board, except where an air quality control system in accordance with **(3)** below is provided. 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) For all ships, where an air quality control system deemed appropriate by the Society is provided, the ventilation system may be operated at a decreased number of air changes and/or a decreased amount of ventilation. This relaxation does not apply to spaces to which at least ten air changes per hour is required by **20.3.2-2** and spaces subject to **19.3.4-1** and **Chapter 20A**.

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 are 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, 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 In case of other than special category spaces below the bulkhead deck, notwithstanding the provisions in -1 above, above a height of 450 *mm* from the deck and from each platform for vehicles, if fitted, except platforms with openings of sufficient size permitting penetration of petrol gases downwards, electrical equipment of a type so enclosed and protected as to prevent the escape of sparks 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*

Except as provided in 20.4.3-1, 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, open vehicle spaces and special category 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.

20.4.3 Special category spaces*

1 An efficient fire patrol system is to be maintained in special category spaces. However, if an efficient fire patrol system is maintained by a continuous fire watch at all times during the voyage, a fixed fire detection and fire alarm systems is not required.

2 Manually operated call points are to be spaced so that no part of the space is more than 20 *m* from a manually operated call point, and one is to be placed close to each exit from such spaces.

20.5 Fire-extinction

20.5.1 Fixed Fire-extinguishing Systems*

1 Vehicle spaces and ro-ro spaces, which are not special category spaces and are capable of being sealed from a location outside of the cargo spaces, are to be fitted with one of the following fixed fire-extinguishing systems:

(1) a fixed gas fire-extinguishing system complying with the provisions of **Chapter 25**;

(2) a fixed high-expansion foam fire-extinguishing system complying with the provisions of **Chapter 26**; or

(3) a fixed water-based fire-fighting system for ro-ro spaces and special category spaces complying with the provisions of **Chapter 27**.

2 Vehicle spaces and ro-ro spaces not capable of being sealed and special category spaces are to be fitted with a fixed water-based fire-fighting system for ro-ro spaces and special category spaces complying with the provisions of **Chapter 27** which is to protect all parts of any deck and vehicle platform in such spaces. Such a water-based fire-fighting system is 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 to ensure complete drainage of the system.

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 pumping 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.

5 In the case of closed vehicle and ro-ro spaces, in cases where fixed water pressure spraying systems are fitted, Society approved means are to be provided to prevent the blockage of the drainage arrangements of such spaces.

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

(2) 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 20A REQUIREMENTS FOR VEHICLE CARRIERS FOR CARRIAGE OF MOTOR VEHICLES WITH COMPRESSED HYDROGEN OR COMPRESSED NATURAL GAS IN THEIR TANKS FOR THEIR OWN PROPULSION AS CARGO

20A.1 General

20A.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 vehicle carriers with vehicle and ro-ro spaces intended for carriage of motor vehicles with compressed hydrogen or compressed natural gas in their tanks for their own propulsion as cargo.

20A.2 General Requirements

20A.2.1 Application

In addition to complying with the requirements of **Chapter 20**, as appropriate, vehicle carriers intended for the carriage of motor vehicles with compressed hydrogen or compressed natural gas in their tanks for their own propulsion as cargo are to comply with the requirements in **20A.3** to **20A.5**.

20A.3 Requirements for Spaces Intended for Carriage of Motor Vehicles with Compressed Natural Gas in their Tanks for their own Propulsion as Cargo

20A.3.1 Electrical Equipment and Wiring*

All electrical equipment and wiring are to be of a certified safe type for use in an explosive methane and air mixture.

20A.3.2 Ventilation Arrangement*

1 Electrical equipment and wiring, if installed in any ventilation duct, are to be of a certified safe type for use in explosive methane and air mixtures.

2 The fans are to be such as to avoid the possibility of ignition of methane and air mixtures. Suitable wire mesh guards are to be fitted over inlet and outlet ventilation openings.

20A.3.3 Other Ignition Sources

Other equipment which may constitute a source of ignition of methane and air mixtures is not to be permitted.

20A.4 Requirements for Spaces Intended for Carriage of Motor Vehicles with Compressed Hydrogen in their Tanks for their own Propulsion as Cargo

20A.4.1 Electrical Equipment and Wiring*

All electrical equipment and wiring are to be of a certified safe type for use in an explosive hydrogen and air mixture.

20A.4.2 Ventilation Arrangement*

1 Electrical equipment and wiring, if installed in any ventilation duct, are to be of a certified safe type for use in explosive hydrogen 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.

2 The fans are to be designed such as to avoid the possibility of ignition of hydrogen and air mixtures. Suitable wire mesh guards are to be fitted over inlet and outlet ventilation openings.

20A.4.3 Other Ignition Sources

Other equipment which may constitute a source of ignition of hydrogen and air mixtures is not to be permitted.

20A.5 Detection

20A.5.1 Portable Gas Detectors*

When a vehicle carrier carries as cargo one or more motor vehicles with either compressed hydrogen or compressed natural gas in their tanks for their own propulsion, at least two portable gas detectors are to be provided. Such detectors are to be suitable for the detection of the gas fuel and be of a certified safe type for use in the explosive gas and air mixture.

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*" (*CS*), "*Smooth Water Service*" (*SWS*) 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.

2 Where such ships other than ships of less than 500 *gross tonnage* or fishing vessels are complying with the modified requirements by **-1** above, they will be registered in the Register of Ships with the descriptive note "*n.f.*".

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 R22.1** and **Fig. R22.1**.

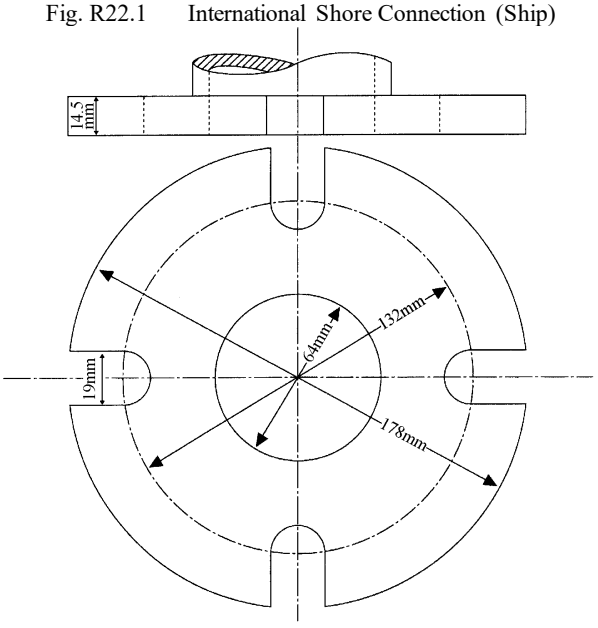
22.2.2 Materials and Accessories

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 R22.1 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 on a bolt circle of the above diameter, slotted to the flange periphery
Flange thickness	14.5 *mm* minimum
Bolts and nuts	4, each of 16 *mm* diameter, 50 *mm* in length

Fig. R22.1 International Shore Connection (Ship)



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

(1) Breathing apparatus is to be a self-contained compressed air breathing apparatus for which, the volume of air contained in the cylinders is to be at least 1,200 *litres*, 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.

(2) Compressed air breathing apparatus is to be fitted with an audible alarm and a visual or other device which will alert the user before the volume of the air in the cylinder has been reduced to no less than 200 *litres*.

3 Lifeline

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. Adjacent spaces with independent ventilation systems not separated by at least "*A*-0" class divisions are to be considered as the same 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. It is not to be necessary to move the containers completely from their fixing position for this purpose. For carbon dioxide systems, hanging bars for a weighing device above each bottle row, or other means are to be provided. For other types of extinguishing media, suitable surface indicators may be used.

(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.

(4) In piping sections where valve arrangements introduce sections of closed piping, such sections are to be fitted with pressure relief valve and the outlet of such valves are to be led to open decks.

(5) All discharge piping, fittings and nozzles in protected spaces are to be constructed of materials having a melting temperature which exceeds 925°C. Such piping and associated equipment are to be adequately supported.

(6) Fitting are to be installed in discharge piping to permit air testing that is required by 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 provisions are 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 and visual warning of the release of fire-extinguishing medium into any ro-ro spaces, container holds equipped with integral reefer containers, spaces accessible by doors or hatches, and other

spaces in which personnel normally work or to which they have access. The audible alarms is to be located so as to be audible throughout the protected space with all machinery operating, and such alarms are to be distinguished from other audible alarms by adjustment of sound pressure or sound patterns. 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 vehicle spaces and ro-ro spaces, the quantity of carbon dioxide 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*. Carbon dioxide systems are not to be used for the protection of special category spaces.

(3) 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;

(4) The percentages specified in **(3)** above may be reduced to 35% and 30%, respectively, for ships of less than 2,000 *gross tonnage*.

(5) For the purpose of this Chapter the volume of free carbon dioxide is to be calculated at 0.56 m^3/kg.

(6) 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*.

(7) For the purpose of this paragraph, in cases where two or more machinery spaces are not entirely separate, they are to be considered as forming one space.

(8) For container and general cargo spaces (primarily intended to carry a variety of cargoes separately secured or packed) the fixed piping system is to be such that at least two thirds of the gas can be discharged into the space within 10 *minutes*. For solid bulk cargo spaces the fixed piping system is to be such that at least two thirds of the gas can be discharged into the space within 20 *minutes*. The system controls are to be arranged to allow one third, two thirds or the entire quantity of gas to be discharged based on the loading condition of the hold.

2 Carbon dioxide systems for the protection of ro-ro spaces, container holds equipped with integral reefer containers, spaces accessible by doors or hatches, and other spaces in which personnel normally work or to which they have 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 for opening the valve of the piping which conveys the gas into the protected space and a second control is to be used to discharge the gas from its storage containers. Positive means are to be provided so they that they can only be operated in that order; 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 1.8N/mm^2 to 2.2N/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, in accordance with the requirements of **4.3.3, Rules for Automatic and Remote Control Systems**, 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 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** and **25.2.3** 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°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 is 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.

27.2.3 Fixed Water-based Fire-fighting Systems for Ro-ro Spaces and Vehicle Spaces*

Fixed water-based fire-fighting systems for ro-ro spaces and vehicle spaces 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 140°C.

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 68°C to 79°C, 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 30°C 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 General

(1) Any parts of the system which may be subjected to freezing temperatures in service is to be suitably protected against freezing.

(2) Special attention is to be paid to the specification of water quality provided by the system manufacturer to prevent internal corrosion of sprinklers and clogging or blockage arising from products of corrosion or scale-forming minerals.

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. For this purpose, nominal area is to be taken as

the gross horizontal projection of the area to be covered. 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.

8 Notwithstanding the provisions in **29.2.1-6(1)**, isolator modules need not be provided at each fire detector if the system is arranged in such a way that the number and location of individually identifiable fire detectors rendered ineffective due to a fault would not be larger than an equivalent section in a section identifiable system, arranged in accordance with **29.2.4-1**.

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 change-over switch is to be arranged such a fault will not result in the loss of both power supplies. 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 The operation of the automatic change-over switch or a failure of one of the power supplies is not to result in loss of fire detection capability. Where a momentary loss of power would cause degradation of the system, a battery of adequate capacity is to be provided to ensure continuous operation during change-over.

3 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.

4 The emergency source of power specified in the preceding **-1** above may be supplied by accumulator batteries or from the emergency switchboard. The power source is to be sufficient to maintain the operation of the fire detection and fire alarm system for the periods required by **3.3, Part H of the Rules**, 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*.

5 Where the system is supplied from accumulator batteries, they are to be located in or adjacent to the control panel for the fire detection system, or in another location suitable for use in an emergency. The rating of the battery charge unit is to be sufficient to maintain the normal output power supply to the fire detection system while recharging the batteries from a fully discharged condition.

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 78°C but not until the temperature exceeds 54°C, when the temperature is raised to those limits at a rate less than 1°C per minute, 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 130°C, and up to 140°C 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 R19.3** 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* 60332-1-2:2004+AMD1:2015.

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 fixed fire detection and fire alarm 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 are to be located on the overhead at 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 R29.1**. 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 R29.1**.

(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 R29.1 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 detection alarm signal at the control panel and indicating units. If the signals have not been acknowledged within 2 *minutes* an audible fire 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 navigation 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. With a cargo control room, an additional indicating unit is to be located in the cargo control room. 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. Detectors installed within cold spaces such as refrigerated compartments are to be tested using procedures having due regard for such locations. 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 metre.

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 on the overhead or as high as possible in the protected space, 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 tonnage* and upwards, not less than 25 m^3/h

(2) for ships less than 2,000 *gross tonnage*, 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 0°C by hand (manual) cracking. Where ready starting cannot be assured, if this is impracticable, or if lower temperatures are likely to be encountered, and if the room for the diesel driven power source is not heated, electric heating of the diesel engine cooling water or lubricating oil system is to be fitted, to the satisfaction of the Society. If hand (manual) starting is impracticable, the Society may permit compressed air, electricity, or other sources of stored energy, including hydraulic power or starting cartridges to be used as a 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. Where the deck foam system is supplied by a common line from the fire main, additional foam concentrate is to be provided for operation of two nozzles for the same period of time required for the foam system. The simultaneous use of the minimum required jets of water is to be possible on deck over the full length of the ship, in the accommodation, service spaces, control stations and machinery spaces.

34.2.2 Component Requirements*

1 Foam solution and foam concentrate

(1) Rate of supply of foam solution

(a) The requirements of **(1)** are to apply to tankers carrying any of the following **i)** to **iii)**:

i) crude oil or petroleum products having a flashpoint not exceeding 60°C (closed cup), as determined by an approved flashpoint apparatus, and a Reid vapour pressure which is below atmospheric pressure or other liquid products having a similar fire hazard, including cargoes in listed **Chapter 18, Part S**, having a flashpoint not exceeding 60°C (closed cup) for which a regular foam fire-fighting system is effective (refer to **1.2.1** and **10.8**);

ii) petroleum products with a flashpoint exceeding 60°C (closed cup), as determined by an approved flashpoint apparatus (refer to **1.2.3-2**); or

iii) products listed in **Chapter 17, Part S** with a flashpoint exceeding 60°C (closed cup) determined by an approved flashpoint apparatus (refer to **11.1.3, Part S** and **1.2.3-2**).

(b) The rate of supply of foam solution is to be not less than the greatest of the following:

i) 0.6 *litres/minute per square metre* 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;

ii) 6 *litres/minute per square metre* of the horizontal sectional area of the single tank having the largest such area; or

iii) 3 *litres/minute per square metre* of the area protected by the largest monitor, such area being entirely forward of the monitor, but in no case is the output of any monitor to be less than 1,250 *litres/minute*.

(2) For tankers carrying chemicals in bulk listed in **Chapter 17, Part S** having a flashpoint not exceeding 60°C (closed cup), the rate of supply of foam solution is to be as required by **11.3.5, Part S**.

(3) 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 or not required to use an inert gas system.

(4) The foam concentrate supplied on board is to be approved by the Society for the cargoes intended to be carried. Type *B* foam concentrates are to be supplied for the protection of crude oil, petroleum products and non-polar solvent cargoes. Type *A* foam concentrates are to be supplied for polar solvent cargoes, as listed in **Table S17.1** of **Chapter 17, Part S**. Only one type of foam concentrate is to be supplied, and it is to be effective for the maximum possible number of cargoes intended to be carried. For cargoes for which foam is not effective or is incompatible, additional arrangements to the satisfaction of the Society are to be

provided.

(5) Liquid cargoes with a flashpoint not exceeding 60°C for which a regular foam fire-fighting system is not effective are to comply with the requirements of **1.2.2-2**.

2 Monitors and foam applicators

(1) Foam from the fixed foam system is to be supplied by means of monitors and foam applicators. Prototype tests of the monitors and foam applicators are to be performed to ensure the foam expansion and drainage time of the foam produced does not differ more than ±10% of that determined in the preceding **-1(4)**. When medium expansion ratio foam (between 21 to 1 and 200 to 1 expansion ratio) is employed, the application rate of the foam and the capacity of a monitor installation are to be to the satisfaction of the Society. At least 50% of the foam solution supply rate is to be delivered from each monitor. On tankers of less than 4,000 *tonnes deadweight* the Society may not require installation of monitors but only applicators. However, in such a case the capacity of each applicator is to be at least 25% of the foam solution supply rate required.

(2) The capacity of any applicator is to be not less than 400 *litres/minute* and the applicator throw in still air conditions is to be not less than 15 *m*.

34.2.3 Installation Requirements*

1 Main control station

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. The monitors and hose connections are to be aft of any cargo tanks, but may be located in the cargo area above pump-rooms, cofferdams, ballast tanks and void spaces adjacent to cargo tanks if capable of protecting the deck below and aft of each other. 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) At least four foam applicators are to be provided on all tankers. 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 Definitions

For the purposes of this chapter,

1 *Cargo tanks* means those cargo tanks, including slop tanks, which carry cargoes, or cargo residues, having a flashpoint not exceeding 60ºC.

2 *Inert gas* system includes inert gas systems using flue gas, inert gas generators, and nitrogen generators and means the inert gas plant and inert gas distribution together with means for preventing backflow of cargo gases to machinery spaces, fixed and portable measuring instruments and control devices.

3 *Gas-safe space* is a space in which the entry of gases would produce hazards with regard to flammability or toxicity.

4 *Gas-free* is a condition in a tank where the content of hydrocarbon or other flammable vapour is less than 1% of the lower flammable limit (*LFL*), the oxygen content is at least 21%, and no toxic gases are present.

35.2.2 Requirements for All Systems*

1 General

(1) The inert gas system referred to in this part is to be designed, constructed and tested to the satisfaction of the Society. It is to be designed to be capable of rendering and maintaining the atmosphere of the relevant cargo tanks non-flammable.

(2) The system is to be capable of the following **(a)** through **(e)**.

(a) inerting empty cargo tanks and maintaining the atmosphere in any part of the tank with an oxygen content not exceeding 8% by volume and at a positive pressure in port and at sea except when it is necessary for such a tank to be gas-free

(b) 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

(c) purging empty cargo tanks of hydrocarbon or other flammable vapours, so that subsequent gas-freeing operations will at no time create a flammable atmosphere within the tank

(d) 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. For chemical tankers and chemical/product tankers, the Society may accept inert gas systems having a lower delivery capacity provided that the maximum rate of discharge of cargoes from cargo tanks being protected by the system is restricted to not more than 80% of the inert gas capacity

(e) delivering inert gas with an oxygen content of not more than 5% by volume to the cargo tanks at any required rate of flow

(3) Materials used in inert gas systems are to be suitable for their intended purpose. In particular, those components which may be subjected 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.

(4) The inert gas supply may be the following **(a)**, **(b)** or **(c)**.

The Society may accept systems using inert gases from one or more separate gas generators or other sources or any combination thereof, provided that an equivalent level of safety is achieved. Such systems are to, as far as practicable, 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.

(a) treated flue gas from main or auxiliary boilers

(b) gas from an oil or gas-fired gas generators

(c) gas from nitrogen generators

(5) An automatic control capable of producing suitable inert gas under all service conditions is to be fitted.

2 Safety measures

(1) 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.

(2) Automatic shutdown of the inert gas system and its components parts are to be arranged on predetermined limits being reached, taking into account the provisions of paragraphs **-4** below, **35.2.3(2)** and **35.2.4(2)**.

(3) Suitable shutoff arrangements are to be provided on the discharge outlet of each generator plant.

(4) The system is to be designed to ensure that if the oxygen content exceeds 5% by volume, the inert gas is to be automatically vented to atmosphere.

(5) Arrangements are to be provided to enable the functioning of the inert gas plant to be stabilized before commencing cargo discharge. If blowers are to be used for gas-freeing, their air inlets are to be provided with blanking arrangements.

(6) Where a double block and bleed valve is installed, the system is to ensure upon of loss of power, the block valves are automatically closed and the bleed valve is automatically open.

3 System components

(1) Non-return devices

(a) At least two non-return devices are to be fitted in order to prevent the return of vapour and liquid to the inert gas plant, or to any gas-safe spaces.

(b) The first non-return device is to be a deck seal of the wet, semi-wet, or dry type or a double-block and bleed arrangement. Two shut-off valves in series with a venting valve in between, may be accepted provided the following **i)** and **ii)** are complied with.

i) The operation of the valve is automatically executed. Signal(s) for opening/closing is (are) to be taken from the process directly, e.g. inert gas flow or differential pressure

ii) alarm for faulty operation of the valves is provided, e.g. the operation status of "blower stop" and "supply valve(s) open" is an alarm condition.

(c) The second non-return device is to be a non-return valve or equivalent capable of preventing the return of vapours and liquids and fitted between the deck water seal (or equivalent device) and the first connection from the inert gas main to a cargo tank. 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 between the non-return valve and the first connection to the cargo tanks to isolate the deck water seal, or equivalent device, from the inert gas main to the cargo tanks.

(d) A water seal, if fitted, 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. The audible and visual alarm on the low level of water in the water seal is to operate at all times.

(e) The arrangement of the water seal, or equivalent devices, and its associated fittings is to be such that it will prevent backflow of vapours and liquids and will ensure the proper functioning of the seal under operating conditions.

(f) 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.

(g) 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. Means are to be provided to prevent such loops from being emptied by vacuum.

(h) Any water seal, or equivalent device, and loop arrangements are to be capable of preventing return of vapours and liquids to an inert gas plant at a pressure equal to the test pressure of the cargo tanks.

(i) The non-return devices are to be located in the cargo area on deck.

(2) Inert gas lines

(a) The inert gas main may be divided into two or more branches forward of the non-return devices required by **(1)** above.

(b) The inert gas main is to be fitted with branch piping leading to the 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. The control system is to provide unambiguous information of the operational status of such valves to at least the control panel required in **-4** below.

(c) Each cargo tank not being inerted is to be capable of being separated from the inert gas main by the followings
  i) removing spool-pieces, valves or other pipe sections, and blanking the pipe ends; or
  ii) arrangement of two spectacle flanges in series with provisions for detecting leakage into the pipe between the two spectacle flanges; or
  iii) equivalent arrangements to the satisfaction of the Society, providing at least the same level of protection.

(d) Means are to be provided to protect cargo tanks against the effect of overpressure or vacuum caused by thermal variations and/or cargo operations when the cargo tanks are isolated from the inert gas mains.

(e) Piping systems are to be so designed as to prevent the accumulation of cargo or water in the pipelines under all normal conditions.

(f) 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. 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.

(g) If a connection is fitted between the inert gas main 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.

(h) The valve separating the inert gas 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.

(i) Inert gas piping systems are not to pass through accommodation, service and control station spaces.

(j) 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 Indicators and alarms

(1) The operation status of the inert gas system is to be indicated in a control panel.

(2) Instrumentation is to be fitted for continuously indicating and permanently recording, when inert gas is being supplied:
  (a) the pressure of the inert gas mains forward of the non-return devices; and
  (b) the oxygen content of the inert gas.

(3) The indicating and recording devices 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.

(4) In addition to **(1)** through **(3)** above, meters are to be fitted:
  (a) in the navigating bridge to indicate at all times the pressure referred to in **(2)(a)** above and the pressure in the slop tanks of combination carriers, whenever those tanks are isolated from the inert gas main; and
  (b) in the machinery control room or in the machinery space to indicate the oxygen content referred to in **(2)(b)** above.

(5) Audible and visual alarms
  (a) Audible and visual alarms are to be provided, based on the system designed, to indicate
    i) oxygen content in excess of 5% by volume
    ii) failure of the power supply to the indicating devices as referred to in **(2)** above.
    iii) gas pressure less than 100 *mm* water gauge. 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
    iv) high-gas pressure
    v) failure of the power supply to the automatic control system
  (b) The alarms required in **(a)i)**, **iii)** and **v)** 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.
  (c) An audible alarm system independent of that required in **(a)iii)** above or automatic shutdown of cargo pumps are to be provided to operate on predetermined limits of low pressure in the inert gas main being reached.
  (d) Two oxygen sensors are to be positioned at appropriate locations in the space or spaces containing the inert gas system. If the oxygen level falls below 19%, these sensors are to be trigger alarms, which are to be both visible and audible inside

and outside the space or spaces and are to be placed in such a position that they are immediately received by responsible members of the crew.

(6) Portable instruments for measuring flammable vapour concentrations

At least two portable gas detectors capable of measuring concentrations of flammable vapours in inerted atmosphere (% gas by volume) are to be provided.

5 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.

35.2.3 Requirements for Flue Gas and Inert Gas Generator Systems*

In addition to the provisions in 35.2.2, for inert gas systems using flue gas or inert gas generators, the following requirements **(1)** and **(2)** are to apply.

(1) System requirements

(a) Inert gas generators

i) Two fuel oil pumps are to be fitted to the inert gas generator. Suitable fuel in sufficient quantity is to be provided for the inert gas generators.

ii) The inert gas generators are to be located outside the cargo tank area. Spaces containing inert gas generators are to have no direct access to accommodation service or control station spaces, but may be located in machinery spaces. If they are not located in machinery spaces, such a compartment is to be separated by a gastight steel bulkhead and/or deck from accommodation, service and control station spaces. Adequate positive-pressure-type mechanical ventilation is to be provided for such a compartment.

(b) Gas regulating valves

i) A gas regulating valve is to be fitted in the inert gas main. This valve is to be automatically controlled to close, as required in 35.2.2-2(2). 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 inert gas flow rate.

ii) The gas regulating valve in **i)** above is to be located at the forward bulkhead of the forward most gas-safe space through which the inert gas main passes.

(c) Cooling and scrubbing arrangement

i) Means are to be fitted which will effectively cool the volume of gas specified in 35.2.2-1(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 also to be made for an alternative supply of cooling water.

ii) Filters or equivalent devices are to be fitted to minimize the amount of water carried over to the inert gas blowers.

(d) Blowers

i) At least two inert gas blowers are to be fitted and be capable of delivering to the cargo tanks at least the volume of gas required by 35.2.2-1(2). For systems fitted with inert gas generators the Society may permit only one blower if that system is capable of delivering the total volume of gas required by 35.2.2-1(2) to the 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.

ii) Where inert gas generators are served by positive displacement blowers, a pressure relief device is to be provided to prevent excess pressure being developed on the discharge side of the blower.

iii) When two blowers are provided, the total required capacity of the inert gas system is to be divided evenly between the two and in no case is one blower to have a capacity less than 1/3 of the total required.

(e) Inert gas isolating valves

For systems using flue gas, flue gas isolating valves are to be fitted in the inert gas mains between the boiler uptakes and the flue gas scrubber. 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 gastight and keep the seatings clear of soot. Arrangements are to be made to ensure that boiler soot blowers cannot be operated when the corresponding flue gas valve is open.

(f) Prevention of flue gas leakage

i) 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.

ii) 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.

(2) Indicators and alarms

(a) In addition to the requirements in **35.2.2-4(2)**, means are to be provided for continuously indicating the temperature of the inert gas at the discharge side of the system, whenever it is operating.

(b) In addition to the requirements of **35.2.2-4(5)**, audible and visual alarms are to be provided to indicate the following **i)** through **vii)**.

i) insufficient fuel oil supply to the oil-fired inert gas generator

ii) failure of the power supply to the generator

iii) low water pressure or low water flow rate to the cooling and scrubbing arrangement

iv) high water level in the cooling and scrubbing arrangement

v) high gas temperature

vi) failure of the inert gas blowers

vii) low water level in the water seal

35.2.4 Requirements for Nitrogen Generator Systems*

In addition to the provisions in paragraph **35.2.2**, for inert gas systems using nitrogen generators, **4.5.3-4(2)**, **4.5.6-3**, **11.6.3-4** and the following requirements **(1)** and **(2)** are to apply.

(1) System requirements

(a) The inert gas is to be produced by separating air into its component gases by passing compressed air through a bundle of hollow fibres, semi-permeable membranes or adsorber materials.

(b) A nitrogen generator is to consist of a feed air treatment system and any number of membrane or adsorber modules in parallel necessary to meet the requirements in **35.2.2-1(2)(d)**.

(c) The nitrogen generator is to be capable of delivering high purity nitrogen in accordance with **35.2.2-1(2)(e)**. In addition to **35.2.2-2(4)**, the system is to be fitted with automatic means to discharge "off-spec" gas to the atmosphere during start-up and abnormal operation.

(d) The system is to be provided with one or more compressors to generate enough positive pressure to be capable of delivering the total volume of gas required by **35.2.2-1(2)**.

(e) Where two compressors are provided, the total required capacity of the system is preferably to be divided equally between the two compressors, and in no case is one compressor to have a capacity less than 1/3 of the total capacity required.

(f) The feed air treatment system fitted to remove free water, particles and traces of oil from the compressed air is to preserve the specification temperature.

(g) The air compressor and nitrogen generator may be installed in the engine-room or in a separate compartment. A separate compartment and any installed equipment is to be treated as an "Other machinery space" with respect to fire protection. Where a separate compartment is provided for the nitrogen generator, the compartment is to be fitted with an independent mechanical extraction ventilation system providing six air changes per hour. The compartment is to have no direct access to accommodation spaces, service spaces and control stations.

(h) Where a nitrogen receiver or a buffer tank is installed, it may be installed in a dedicated compartment, in a separate compartment containing the air compressor and the generator, in the engine room, or in the cargo area. Where the nitrogen receiver or a buffer tank is installed in an enclosed space, the access is to be arranged only from the open deck and the access door is to open outwards. Adequate, independent mechanical ventilation, of the extraction type, is to be provided for such a compartment.

(i) The oxygen-enriched air from the nitrogen generator and the nitrogen-product enriched gas from the protective devices of the nitrogen receiver are to be discharged to a safe location on the open deck.

(j) In order to permit maintenance, means of isolation are to be fitted between the generator and the receiver.

(2) Indicators and alarms

(a) In addition to the requirements in **35.2.2-4(2)**, instrumentation is to be provided for continuously indicating the temperature and pressure of air at the suction side of the nitrogen generator.

(b) In addition to the requirements in **35.2.2-4(5)**, audible and visual alarms are to be provided to include:

i) Failure of the electric heater, if fitted;

ii) Low feed-air pressure or flow from the compressor;

iii) High-air temperature; and

iv) High condensate level at automatic drain of water separator.

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, Part R of the Rules**.

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 1 *m* 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 analysing 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 analysing 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.

Chapter 37 Helicopter Facility Foam Firefighting Appliances

37.1 General

37.1.1 Application

This chapter details the specifications for foam firefighting appliances for the protection of helidecks and helicopter landing areas as required in this Part.

37.2 Definitions

37.2.1 D-value

D-value means the largest dimension of the helicopter used for assessment of the helideck when its rotors are turning. It establishes the required area of foam application.

37.2.2 Deck Integrated Foam Nozzles

Deck integrated foam nozzles are foam nozzles recessed into or edge mounted on the helideck.

37.2.3 Foam-making Branch Pipes

Foam-making branch pipes are air-aspirating nozzles in tube shape for producing and discharging foam, usually in straight stream only.

37.2.4 Helicopter Landing Area

Helicopter landing area is as defined in 3.2.55.

37.2.5 Helideck

Helideck is as defined in 3.2.26.

37.2.6 Hose Reel Foam Station

Hose reel foam station is a hose reel fitted with a foam-making branch pipe and non-collapsible hose, together with fixed foam proportioner and fixed foam concentrate tank, mounted on a common frame.

37.2.7 Monitor Foam Station

Monitor foam station is a foam monitor, either self-inducing or together with separate fixed foam proportioner, and fixed foam concentrate tank, mounted on a common frame.

37.2.8 Obstacle Free Sector

Obstacle free sector is the take-off and approach sector which totally encompasses the safe landing area and extends over a sector of at least 210 *degrees*, within which only specified obstacles are permitted.

37.2.9 Limited Obstacle Sector

Limited obstacle sector is a 150 *degrees* sector outside the take-off and approach sector that extends outward from a helideck where objects of limited height are permitted.

37.3 Engineering Specifications

37.3.1 General

The system is to be capable of manual release, and may be arranged for automatic release.

37.3.2 Foam Firefighting Appliances for Helidecks

1 For helidecks the foam system is to contain the following **(1)** and **(2)**.

(1) At least two fixed foam monitors or deck integrated foam nozzles.

(2) At least two hose reels fitted with a foam-making branch pipe and non-collapsible hose sufficient to reach any part of the helideck.

2 The minimum foam system discharge rate for fixed foam monitors is to be determined by multiplying the D-value area by 6 $l/min/m^2$.

3 The minimum foam system discharge rate for deck integrated foam nozzle systems is to be determined by multiplying the overall helideck area by 6 $l/min/m^2$.

4 Each monitor is to be capable of supplying at least 50 % of the minimum foam system discharge rate, but not less than 500 *l/min*.

5 The minimum discharge rate of each hose reel is to be at least 400 *l/min*.

6 The quantity of foam concentrate is to be adequate to allow operation of all connected discharge devices for at least 5 *min*.

37.3.3 Foam Monitors

Where foam monitors are installed, the distance from the monitor to the farthest extremity of the protected area is to be not more than 75 % of the monitor throw in still air conditions.

37.3.4 Foam Firefighting Appliances for Helicopter Landing Areas

1 For helicopter landing areas, at least two portable foam applicators or two hose reel foam stations are to be provided, each capable of discharging a minimum foam solution discharge rate, in accordance with **Table R37.1**.

2 The quantity of foam concentrate is to be adequate to allow operation of all connected discharge devices for at least 10 *min*. For tankers fitted with a deck foam system, the Society may consider an alternative arrangement, taking into account the type of foam concentrate to be used.

Table R37.1 Foam Discharge Rates for Helicopter Landing Areas

Category	Helicopter overall length (D-value)	Minimum foam solution discharge rate (*l/min*)
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

37.3.5 Manual Release Stations

1 Manual release stations capable of starting necessary pumps and opening required valves, including the fire main system, if used for water supply, are to be located at each monitor and hose reel.

2 A central manual release station is to be provided at a protected location.

3 Activation of any manual release station is to initiate the flow of foam solution to all connected hose reels, monitors, and deck integrated foam nozzles.

4 The foam firefighting system is to be designed to discharge foam with nominal flow and at design pressure from any connected discharge devices within 30 *s* of activation.

37.3.6 Manufacture and Testing

The system and its components are to be designed to withstand ambient temperature changes, vibration, humidity, shock impact and corrosion normally encountered on the open deck, and are to be manufactured and tested to the satisfaction of the Society.

37.3.7 Performance of Hose Reels, Monitors and Deck Integrated Foam Nozzles*

1 A minimum nozzle throw of at least 15 *m* is to be provided with all hose reels and monitors discharging foam simultaneously.

2 The discharge pressure, flow rate and discharge pattern of deck integrated foam nozzles are to be to the satisfaction of the Society, based on tests that demonstrate the nozzle's capability to extinguish fires involving the largest size helicopter for which the helideck is designed.

37.3.8 Materials

Monitors, foam-making branch pipes, deck integrated foam nozzles and couplings are to be constructed of brass, bronze or stainless steel. Piping, fittings and related components, except gaskets, are to be designed to withstand exposure to temperatures up to 925 °C.

37.3.9 Foam Concentrates*

The foam concentrate is to be demonstrated effective for extinguishing aviation fuel spill fires and is to conform to performance standards not inferior to those acceptable to the Society. Where the foam storage tank is on the exposed deck, freeze protected foam concentrates are to be used, if appropriate, for the area of operation.

37.3.10 Height of Obstacle*

Any foam system equipment installed within the take-off and approach obstacle-free sector is not to exceed a height of 0.25 *m*. Any foam system equipment installed in the limited obstacle sector is not to exceed the height permitted for objects in this area.

37.3.11 Means of Access

All manual release stations, monitor foam stations, hose reel foam stations, hose reels and monitors are to be provided with a means of access that does not require travel across the helideck or helicopter landing area.

37.3.12 Oscillating Monitors

Oscillating monitors, if used, are to be pre-set to discharge foam in a spray pattern and have a means of disengaging the oscillating mechanism to allow rapid conversion to manual operation.

37.3.13 Use of Air-aspirating Nozzles

1 If a foam monitor with flow rate up to 1,000 *l/min* is installed, it is to be equipped with an air-aspirating nozzle.

2 If a deck integrated nozzle system is installed, then the installed hose reel is to be equipped with an air-aspirating handline nozzle (foam branch pipes).

3 If only portable foam applicators or hose reel stations are provided, these are to be equipped with an air-aspirating handline nozzle (foam branch pipes).

4 Use of non-air-aspirating foam nozzles (on both monitors and the hose reel) is permitted only where foam monitors with a flow rate above 1,000 *l/min* are installed.

Contents

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part R FIRE PROTECTION, DETECTION AND EXTINCTION

R1 GENERAL

R1.2 Application of Requirements for Tankers

R1.2.1 Application to Tankers

Vegetable oil, latex and molasses are not regarded as "other liquid cargoes having similar fire hazards" referred to in **1.2.1, Part R of the Rules**.

R1.2.2 Additional Requirements

With respect to the requirements of **1.2.2-2, Part R of the Rules**, the following standards are to be referred to for determining the foam concentrate.

(1) *Revised guidelines for the performance and testing criteria, and surveys of foam concentrates for fixed fire-extinguishing systems* (*MSC*.1/*Circ.*1312)

(2) *Information on flashpoint and recommended fire-fighting media for chemicals to which neither the IBC nor BCH Codes apply* (*MSC/Circ.*553)

R3 DEFINITIONS

R3.1 General

R3.1.1 General Rules

In respect of fire protection materials specified in **Part R of the Rules**, the wording "approved by the Society in accordance with the Fire Test Procedures Code" means those complied with the test standards specified in **Chapter 1, Part 4 of GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE** and approved by the Society.

R3.2 Definitions

R3.2.1 Accommodation Spaces

The Following devices **(1)** and **(2)** may be provided in "pantries containing no cooking appliances" specified in **3.2.1, Part R of the Rules**.

(1) Toasters, microwave ovens, induction heaters and similar appliances each of them with a maximum power of 5 *kW*. However, coffee machines, dish washers and water boilers with no exposed hot surfaces may be provided in these pantries regardless of their power; and

(2) Electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of 2 *kW* and a surface temperature not above 150°C.

R3.2.2 "*A*" Class Divisions

The materials, details and arrangements of "*A*" *class divisions* and the means of affixing the insulation used on board ships are to be consistent with the detail drawings referred to on the Certificate of Approval for Fire Protection Material.

R3.2.4 "*B*" Class Divisions

A division constructed of non-combustible core materials coated by combustible veneers may be accepted as a "*B*" *class division* provided the following conditions are satisfied:

(1) the non-combustible core materials are tested in accordance with Part 1, Annex 1 of the *FTP* Code;

(2) the "*B*" *class division* is tested in accordance with Part 3, Annex 1 of the *FTP* Code; and

(3) the veneers are tested in accordance with the Part 2 (if applicable) and Part 5, Annex 1 of the *FTP* Code.

R3.2.8 Cargo Spaces

With respect to the provisions of **3.2.8, Part R of the Rules**, trunks lead to cargo spaces need not be regarded as "cargo spaces", provided that the trunks are separated from the cargo spaces by effective closing devices and are, in the opinion of the Society, not having similar risk as cargo spaces.

R3.2.10 "*C*" Class Divisions

A division constructed of non-combustible core materials but coated with combustible veneers may be accepted as a "*C*" *class division* provided that the following conditions are satisfied:

(1) the non-combustible core materials are tested in accordance with Part 1, Annex 1 of the *FTP* Code; and

(2) the veneers are tested in accordance with Part 2 (if applicable) and Part 5, Annex 1 of the *FTP* Code.

R3.2.18 Control Stations

1 The wording "main navigational equipment" specified in the provisions of **3.2.18, Part R of the Rules**, includes the steering stand, the compass, radar equipment.

2 The steering gear room provided with the emergency steering position may not be regarded as "control station" specified in **3.2.18, Part R of the Rules**.

3 With respect to the provisions of **3.2.18, Part R of the Rules**, spaces where major components of a fixed fire-extinguishing system are provided need not to be considered as a control station, except where in **Part R of the Rules** relevant to fixed fire-extinguishing systems there are no specific requirements for the centralization within a control station of such major components.

However, the fire integrity for storage rooms of fire-extinguishing medium for fixed fire-extinguishing systems is to be in accordance with the provisions of **10.4.3(7), Part R of the Rules** and **Table R9.2.3-1**.

4 Spaces which contain the following electrical batteries are regarded as "control station" specified in **3.2.18, Part R of the Rules** irrespective of the capacity of batteries.

(1) Batteries for the emergency source of electrical power specified in **3.3.3, Part H of the Rules**.

(2) Batteries for the transitional source of emergency electrical power specified in **3.3.4, Part H of the Rules**.

(3) Batteries for starting of the emergency generator specified in **3.4.1, Part H of the Rules**.

(4) Batteries for the reserve source of energy specified in Regulation 13, Chapter IV of *SOLAS*.

R3.2.28 Lightweight

With respect to the provisions of **3.2.28, Part R of the Rules**, the weight of mediums on board for the fixed firefighting systems (e.g. freshwater, CO_2, dry chemical powder, foam concentrate, etc.) is to be included in the lightweight.

R3.2.31 Machinery Spaces of Category *A*

Incinerators specified in **3.2.31, Part R of the Rules** is those with a maximum combustion capacity over 34.5 *kW*.

R3.2.39 Public Spaces

Electrical equipment specified in **R3.2.1** may be provided in "dining rooms" specified in **3.2.39, Part R of the Rules**.

R3.2.41 Ro-ro Spaces

The wording "spaces not normally subdivided in any way" in the definition of ro-ro spaces given in **3.2.41, Part R of the Rules** means those spaces which are not subdivided in longitudinal direction by watertight bulkheads or gas-tight bulkheads.

R3.2.45 Service Spaces

The Following devices **(1)** and **(2)** may be provided in "pantries containing cooking appliances" specified in **3.2.45, Part R of the Rules**. However, spaces containing any electrically heated cooking plate or hot plate for keeping food warm with a power of more than 5 *kW* are to be regarded as galleys.

(1) Toasters, microwave ovens, induction heaters and similar appliances each of them with a power of more than 5 *kW*. However, coffee machines, dish washers and water boilers may be provided in these pantries regardless of their power; and

(2) Electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of 5 *kW*.

R3.2.54 Vehicle Carrier

The definition of "vehicle carrier" specified in **3.2.54, Part R of the Rules** is intended for pure car and truck carriers, and excludes other types ro-ro cargo ships or container/ro-ro ships, even when carrying empty cars and trucks as cargo.

R4 PROBABILITY OF IGNITION

R4.2 Arrangements for Oil Fuel, Lubrication Oil and Other Flammable Oils

R4.2.1 Limitations in the Use of Oils as Fuel

1 The wording "other requirements when deemed appropriate by the Society" referred to in **4.2.1(3)(e), Part R of the Rules** means those as follows:

(1) Filling pipes and sounding pipes of fuel oil tanks are to be of permanently fixed ones led above the weather deck. Sounding rod is to be of non-ferrous metal material.

(2) Sounding device is to be so located that tank sounding can readily be taken at a place near the filling connection.

(3) The fuel oil is not to be heated to a temperature of 38°C or more.

(4) Oil drip trays for fuel oil tanks and fuel oil strainers are to be covered with a wire gauze and the leaked oil collected in the oil trays is to be led to an exclusive drain tank having no opening to the engine room.

2 The wording "considered appropriate by the Society" in **4.2.1(6), Part R of the Rules** means that fuel oil service tanks, settling tanks or other tanks provided in fuel oil supply systems which satisfy the following conditions:

(1) The length of the vent pipes from such tanks and/or cooling devices are sufficient for cooling the vapours to below 60°C, or the outlet of the vent pipes to be located 3 *m* away from a source of ignition.

(2) The open-end device of vent pipes are fitted with flame screens.

(3) There are no openings from the vapour space of the fuel oil tanks into machinery spaces (bolted manholes with gaskets are acceptable).

(4) Enclosed spaces are not located right above the fuel oil tanks, except for well-ventilated cofferdams.

R4.2.2 Arrangements for Oil Fuel

1 With respect to the requirements specified in **4.2.2(2), Part R of the Rules**, the compartments in which fuel oil burning systems, fuel oil settling and service tanks, fuel oil purifiers, etc. are located are to be specially well ventilated.

2 The wording "forepeak tanks" specified in **4.2.2(3)(a), Part R of the Rules** means tanks positioned forward the collision bulkhead except portable tanks.

3 With respect to the requirements of **4.2.2(3)(b), Part R of the Rules**, a standard arrangement of fuel oil tanks in machinery spaces of category *A* is shown in **Fig. R4.2.2-1**.

4 With respect to the requirements specified in **4.2.2(3)(b), Part R of the Rules**, in case where "free standing oil fuel tanks" are provided in machinery spaces of category *A* due to unavoidable reasons, the capacity of such tanks is not to exceed that to run the main propulsion machinery continuously for 15 *hours*.

5 As for the enough distance specified in **4.2.2(3)(c), Part R of the Rules**, the horizontal distance between the tank of flammable oil and the rear face of boilers, thermal oil heaters or incinerators is to be 610 *mm* or more, and that between the tanks and the other portions of boilers is to be 460 *mm* or more. However, the distance between the tank and the cylindrical part of boiler drums or between the tank and the corner of water-tube boiler casings may be reduced to 230 *mm*.

6 With respect to the requirements of **4.2.2(3)(d), Part R of the Rules**, pneumatic remote shut-down devices (of the type that needs compressed air only at the time of closing) of main suction valves of fuel oil tanks are to comply with the following requirements:

(1) An exclusive air bottle for remote shut-down is to be provided in an easily accessible position outside the compartment in which fuel oil tanks are situated.

(2) The capacity of air bottle is to be sufficient for closing all the main suction valves of fuel oil tanks at least twice.

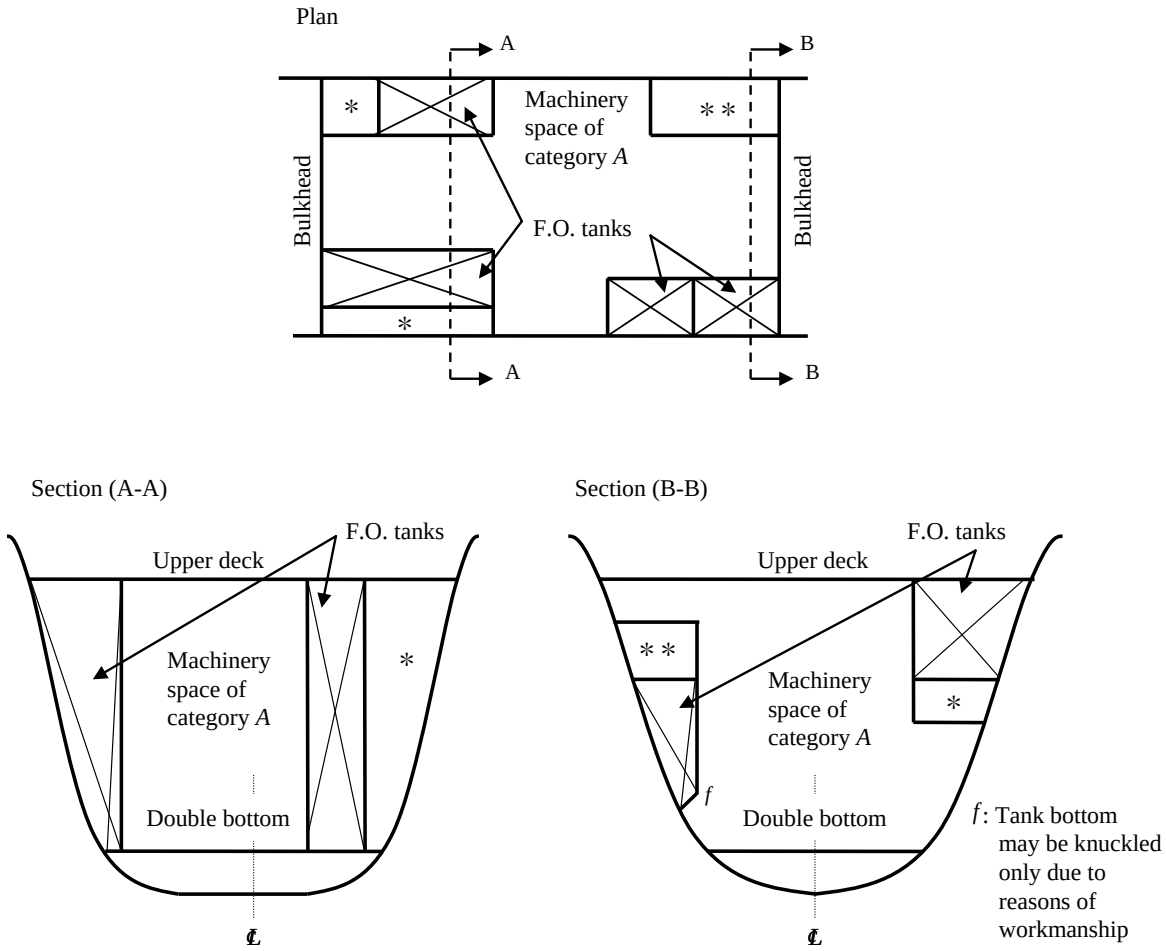
(3) The air bottle is to be provided with a pressure indicating device at a position which can be easily seen from the position to operate.

(4) Air pipes from the air bottle to the main suction valve's actuators are not to be provided with any valve except for air outlet valves and blow-off valves for these pipes.

(5) Air pipes from the air bottle to the main suction valve's actuators are to be of steel or copper.

(6) Air charging pipes to the air bottle are to be provided with non-return valves.

Fig. R4.2.2-1



Notes

* Cofferdams complying with the following requirements;

1. to be gas-tight; and
2. to be provided with sounding devices, air escape pipes and fittings for drainage (drain plug, etc.).
3. cofferdams provided under fuel oil tanks are to have sufficient depth.

* * Void spaces having sufficient depth are to be provided on the tops of fuel oil tanks, and are permitted to have openings. However, in cases where pipe passages for other than flammable liquids, and/or auxiliary machinery rooms having little fire risk, such as fan rooms, conditioning machinery rooms, refrigerating machinery rooms and rooms for hydraulic systems, are provided on the top of fuel oil tanks, it is not necessary to provide the aforementioned void space.

7 In case where air bottles specified in **-6** above are used commonly for remote shut-down of the fuel tank valves for the emergency generator, remote opening of the sea water suction valve of the emergency fire pump, remote shut-down of dampers for the ventilating fans for machinery spaces, etc, the following requirements are to be complied with:

(1) The capacity of the air bottle is to be capable of operating simultaneously all remote controls belonging to at least twice.

(2) The air piping for the remote shut-down of fuel oil tank main suction valve is to be arranged separately from pipings for other purposes, and the air outlet valve from the air bottle is to be fitted with a name tag for clear identification of the intended service.

(3) The air piping system for remote shut-down of the fuel tank valves for the emergency generator is to comply with **(2)** mentioned above and to be independent from the other air piping system.

8 With respect to the requirements specified in **4.2.2(3)(d), Part R of the Rules**, the oil fuel pipes, which, if damaged, would allow oil to escape from a storage, settling or daily service tank means that a valve or a cock of such pipes from the tanks is normally open.

9 The wording “the approved ones by the Society” in **4.2.2(3)(e)ii), Part R of the Rules** means the oil level gauges approved

in accordance with the requirements of **Chapter 4, Part 7 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use** and the wording "the standard deemed approved by the Society" means the *JIS F* 7215 "Flat glass oil level gauges" or equivalent.

10 As for the provisions to prevent overpressure specified in **4.2.2(4), Part R of the Rules**, where pressure relief valves are provided on the delivery side of the fuel oil pumps, arrangements are to made so that the discharged oil is led to the suction side of the pump.

11 With respect to the requirements in **4.2.2(5)(a), Part R of the Rules**, a material may be accepted as other material approved by the Society for engine, turbine and gearbox, in cases where the material is used for any of the following **(1)** to **(3)** cases:

(1) Internal pipes which cannot cause any release of flammable fluid onto the machinery or into the machinery space in the case of failure;

(2) Components which are only subject to liquid spray on the inside in cases where the machinery is running; for example, machinery covers, rocker box covers, camshaft end covers, inspection plates and sump tanks. However in such cases, the pressure inside these components and all the elements contained therein is to be less than 0.18 N/mm^2 and that wet sumps are to have a volume not exceeding 100 *litres*; or

(3) Components attached to machinery which satisfy fire test criteria according to *ISO* standard 19921:2005 and 19922:2005 or other standards acceptable to the Society, and which retain mechanical properties adequate for the intended installation.

12 If flexible hoses are used as a jacketed piping system required in **4.2.2(5)(b), Part R of the Rules**, these are to be of an approved type.

13 The wording "appropriate designs, constructions and arrangements for minimizing the fire risk" specified in **4.2.2(5)(b), Part R of the Rules** means that the diesel engine meets all the following conditions:

(1) to be installed in a space other than machinery spaces of category *A*;

(2) to be of a single cylinder engine so as to automatically stop by a spillage from the high pressure oil fuel pipe; and

(3) to have a suitable shield for the high pressure oil fuel pipe or whole of the engine so as to prevent oil spray or oil leakage onto ignition sources.

14 The wording "other suitably protected to avoid oil spray or oil leakage onto the sources of ignition" specified in **4.2.2(5)(c), Part R of the Rules** means the following preventive measures which are subject to approval by the society upon submission of those drawings or documents.

(1) Anti-splashing tape

(2) Metal flange cover designed in accordance with *IMO MSC/Circ.*647

(3) Other appropriate preventive measures against oil spray

15 With respect to the requirements in **4.2.2(5)(c), Part R of the Rules**, it is considered unnecessary to provide protective means for the following arrangements as the danger caused by an oil spray or an oil leakage is considered relatively low.

(1) Pipings of flammable oil located below the floor plates.

(2) Effective insulation in way of the joints of flammable oil.

16 The means of isolating specified in **4.2.2(5)(e), Part R of the Rules** are to be provided at the position in the engine room where is capable of operating safely and ascertaining the fire condition in case of fire of the engine. With respect to return pipings from engines, non-return valves may be acceptable as the means of isolating.

17 With respect to the requirements in **4.2.2(6)(a), Part R of the Rules** where the insulation is of oil absorbent material or may permit the penetration of oil, the insulation is to be encased in sheathing of steel or equivalent material, except those installed in a place having no fire risk.

18 With respect to the requirements of **4.2.2(8), Part R of the Rules**:

(1) The wording "each space where pre-treatment machinery for flammable liquid is installed" means the space where the following system with a heating device for the flammable liquid is installed:

  (a) System of preparing fuel for boilers.

  (b) System of preparing fuel for main propulsion machinery and auxiliary machinery.

  (c) System of preparing flammable liquid with the working pressure above 1.6 *MPa*.

(2) The wording "where as deemed appropriate by the Society" means the case where the pre-treatment equipment is arranged in a space with less possibility of fire in the engine room according to the requirement of **4.2.2(5)(c), Part R of the Rules** and the

following conditions **(a)** and **(b)** are complied with.

(a) An independent mechanical ventilation system of self-suction type is provided for the space or the duct openings of the ventilating systems specified in **1.3.5, Part D of the Rules** are arranged in a proper position for the ventilation of the space.

(b) A fixed fire-extinguishing system of that specified in **(3)**, and of either one of the following types is provided for the space.

i) A system capable being activated automatically

ii) A system capable being operated from positions where they will not be cut off in the event of fire in the space they serve, and provided in combination with a fixed fire detection and fire alarm system

(3) The wording "a fixed fire-extinguishing system deemed as appropriate by the Society" in the requirement of **4.2.2(8)(b)ii), Part R of the Rules** means either one of the following systems.

(a) A fixed fire-extinguishing system as specified in **10.5.1-1, Part R of the Rules** (excluding fire-extinguishing systems using such a dangerous gas as CO_2).

(b) A local application fixed fire-fighting system as specified in **10.5.5, Part R of the Rules**

(c) A fixed fire-extinguishing system as deemed equivalent to those specified in **(a)** or **(b)**

R4.2.3 Arrangements for Lubricating Oil

With respect to the provisions of **4.2.3, Part R of the Rules**, air pipes from unheated lubricating oil tanks may terminate in the machinery space, provided that the open ends are so situated that issuing oil cannot come into contact with electrical equipment or heated surface.

R4.2.4 Arrangements for Other Flammable Oils

1 The wording "having no danger of fire caused by the spillage" in the provisions of **4.2.4-1, Part R of the Rules** means that the hydraulic valves and the cylinders are provided in the space, such as tanks or cofferdams, having no ignition sources, or in the space, such as weather deck, having low risk of contact with ignition sources and where oil spillage may be detected easily.

2 With respect to the provisions of **4.2.4-1, Part R of the Rules**, air pipes may be in accordance with the provisions of **R4.2.3**.

R4.3 Arrangements for Gases for Domestic Purpose

R4.3.1 Arrangements for Gaseous Fuel for Domestic Purpose

1 With respect to the requirements of **4.3.1, Part R of the Rules**, gas bottles, pipes, valves and pipe fittings of the gaseous fuel systems are to comply with an international or national standard deemed appropriate by the Administration or the Society, in spite of the provisions of **Part D of the Rules**.

2 Gas bottles are to be protected appropriately according to characters of used gases. In general, gas bottles are to be stored in areas not exposed to direct sun beam and also safe against waves, flame and high temperature, and secured so that the safety against ship motions and vibrations is ensured.

3 With respect to the provisions of **4.3.1, Part R of the Rules**, a portion of open deck, recessed into deck structure, machinery casing, deck house, etc., utilized for the exclusive storage of gas bottles is to comply with the following requirements.

(1) Such a recess is to have an unobstructed opening, except for small appurtenant structures, such as opening corner radii, small sills, pillars, etc. The opening may be provided with grating walls and door.

(2) The depth of such a recess is not to be greater than 1 *m*, where the depth means the maximum horizontal distance between the recessed wall and the wall of deck structure, machinery casing, deck house, etc.

4 A storage space 3 sides of which are closed is to be regarded as a recessed space and comply with the requirements of **-3** above.

5 With respect to the provisions of **4.3.1, Part R of the Rules**, where gas bottles are stored in a space other than open decks, such a space is to be provided with appropriate mechanical ventilation. In this context, portions of open deck complying with the provisions in **-3** above may be regarded as open decks. Electrical installations provided within storage spaces other than open decks or 3 *m* of ventilation outlets for the spaces are to comply with the requirements of **2.1.3-7, Part H of the Rules**.

R4.3.2 Arrangements for Gas Welding Equipments

1 With respect to the requirements of **4.3.2, Part R of the Rules**, gas welding equipments using acetylene and oxygen are to conform to the following provisions.

2 Gas bottles, pipes, valves and pipe fittings of the gas welding equipments are to comply with an international or national standard deemed appropriate by the Administration or the Society, in spite of the provisions of **Part D of the Rules**.

3 The location of gas bottles is to be as specified below:

(1) Gas bottles are to be stored in areas not exposed to direct sunlight and also safe against waves, fire and high temperature. Appropriate consideration is to be given so that in general the temperature of the bottles is not higher than 40°C.

(2) Gas bottles are to be secured so that the safety against ship motions and vibrations is ensured, and they should stand upright. Further, means are to be provided so that the bottles can be transferred quickly in case of fire.

(3) Acetylene bottles and oxygen bottles are to be stored apart as far as practicable.

4 With respect to the provisions of **4.3.2, Part R of the Rules**, a portion of open deck, recessed into deck structure, machinery casing, deck house, etc., utilized for the exclusive storage of gas bottles is to comply with the following requirements.

(1) The deck area of such a recess is not to be excessive large.

(2) Such a recess is to have an unobstructed opening, except for small appurtenant structures, such as opening corner radii, small sills, pillars, etc. The opening may be provided with grating walls and door.

(3) The depth of such a recess is not to be greater than the width of the recess, where the depth means the maximum horizontal distance between the recessed wall and the wall of deck structure, machinery casing, deck house, etc.

5 A storage space in which 3 sides are closed is to be regarded as a recessed space and comply with the requirements of **-4** above.

6 With respect to the provisions of **4.3.2, Part R of the Rules**, where gas bottles are stored in a space other than open decks, such a space is to be provided with appropriate mechanical ventilation. In this context, portions of open deck complying with the provisions in **-4** above may be regarded as open decks. Electrical installations provided within storage spaces other than open decks or 3 *m* of ventilation outlets for the spaces are to comply with the requirements of **2.1.3-7, Part H of the Rules**.

7 Storage spaces exclusively used for oxygen bottles need not to comply with the provisions of **-4(3)** above.

8 Piping between the gas bottles and working area is to comply with the following provisions.

(1) Steel pipes with corrosion protection are to be used for acetylene gas piping, and steel or copper pipes are to be used for oxygen gas piping. Use of flexible joints made of non-metal material ensleeved in metal sheath in part of the piping may be accepted.

(2) No cast iron is to be used as material for valves and pipe fittings. Further, copper or copper alloy with a copper content exceeding 62% is not to be used as the material of valves and pipe fittings in the acetylene gas piping.

(3) The procedures of piping arrangement are to be as specified below.

(a) Acetylene gas piping and oxygen gas piping are not to be led through the control stations, accommodation spaces, service spaces of high fire risk, machinery spaces and cargo spaces and other enclosed spaces where any installation which is susceptible to fire is installed.

(b) On acetylene gas piping and oxygen gas piping, stop valves are to be fitted at adequate location of the penetrations through the casing of storage room and working area.

(c) Joints between pipes and pipe fittings are to be welded joint or flange joint as far as practicable.

(d) For clear distinction of the acetylene gas piping system and oxygen gas piping system, the piping systems are to be provided with adequate means of identification.

(4) In case where rubber pipes are used between gas bottles and working area, the rubber pipes are to be of the ones complying with the requirements of any recognized standard deemed adequate by the Society according to the type of gas involved.

(5) After completion of shipboard installation, piping systems are to be subjected to air-tightness test at a pressure of 1.25 *times* or more of the maximum working pressure of the pressure regulator.

R4.4 Miscellaneous Items of Ignition Sources and Ignitability

R4.4.2 Waste Receptacles

With respect to the provisions of **4.4.2, Part R of the Rules**, receptacles constructed of combustible materials may be allowed for the use in galleys, pantries, bars, garbage handling or storage spaces and incinerator rooms provided they are intended purely for the carriage of wet waste, glass bottles and metal cans and are suitably marked.

R4.4.3 Insulation Surfaces Protected against Oil Penetration

The wording “spaces where penetration of oil products is possible” specified in **4.4.3, Part R of the Rules** means the spaces located in the vicinity of all types of equipment (purifiers, pumps and tanks) and pipe fittings (valves, flanges, strainers, flow meters,

etc.) handling oils (fuel oil, lubricating oil, hydraulic oil and thermal oil) with possible reach of oils or oil vapours leaked or splashed during operation or maintenance work to the thermal insulation. However, the requirements specified in **4.4.3, Part R of the Rules** do not apply to the thermal insulation of pipes in machinery spaces.

R4.4.4 Primary Deck Coverings

The wording "primary deck coverings" specified in **4.4.4, Part R of the Rules** means the first layer of a floor construction which is applied directly on the top of deck plating and is inclusive of any primary coat, anti-corrosive compound or adhesive which is necessary to provide protection or adhesion to the deck plating. In this connection, "the first layer" means the materials forming a deck covering excluding "*A*" class decks (including insulation materials), non-combustible materials and "fire retardant surface flooring".

R4.5 Cargo Areas of Tankers

R4.5.1 Separation of Cargo Tanks and Location of Fuel Tanks

1 The wording "such pump rooms have the same safety standard as that required for cargo pump rooms" specified in **4.5.1-1, Part R of the Rules** means that the pump rooms are to comply with all requirements applied to cargo pump rooms in **this Part** (except the requirements for fixed fire fighting systems in **10.9, Part R of the Rules**).

2 With respect to the requirements specified in **4.5.1-1, Part R of the Rules**, pump rooms intended solely for ballast transfer need not comply with the requirements of **4.5.10, Part R of the Rules**.

3 With respect to the requirements specified in **4.5.1-1, Part R of the Rules**, pump rooms containing cargo pumps, stripping pumps, pumps for slop tanks, pumps for COW or similar pumps are to comply with the requirements of **4.5.10, Part R of the Rules** regardless of their location. For the purpose of this requirement, "similar pumps" includes pumps intended for transfer of fuel oil having a flashpoint of less than 60°C. Pump-rooms intended for fuel oil transfer having a flashpoint of not less than 60°C need not comply with the requirements of **4.5.10, Part R of the Rules**.

4 With respect to the provisions of **4.5.1-1, Part R of the Rules**, void spaces, etc. protecting an oil fuel tank(s) in the machinery space as shown in **Fig. R4.5.1-1** need not to be positioned forward of machinery spaces, even though they have a cruciform contact with the cargo oil tank or slop tank.

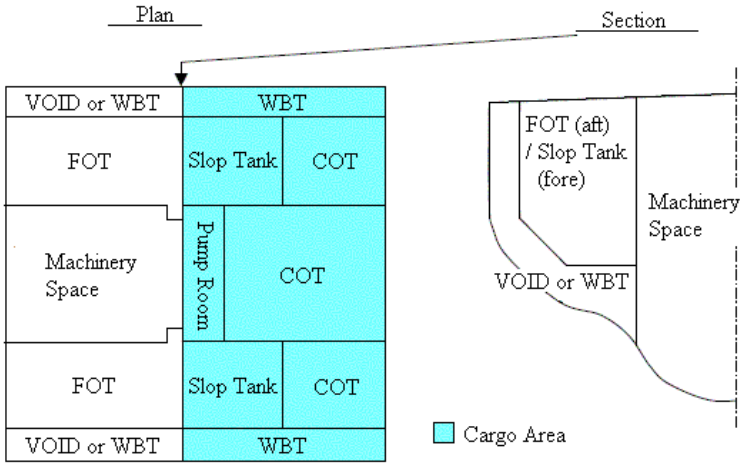
5 With respect to the requirements of **4.5.1-2, Part R of the Rules**, the arrangement of accommodation spaces, main cargo control stations, control stations and service spaces is to comply with the following **(1)** to **(3)**:

(1) Accommodation spaces, main cargo control stations, control stations and service spaces are to make neither point contacts nor linear contacts with cargo oil tanks or slop tanks. However, they may make point contacts or linear contacts with cargo pump rooms and cofferdams.

(2) Accommodation spaces, main cargo control stations, control stations and service spaces need not be arranged aft of the recess of the lower parts of cargo pump rooms and ballast pump rooms into machinery spaces of category *A* which is accepted under the requirements of **4.5.1-1, Part R of the Rules**, as well as aft of the oil fuel tanks and ballast tanks. (See **Fig.R4.5.1-2**)

(3) The expression "cofferdam" means an isolating space between two adjacent steel bulkheads or decks. The minimum distance between the two bulkheads or decks is to be sufficient for safe access and inspection. In case when a corner-to-corner situation occurs, small cofferdam made by welding a diagonal plate across the corner may be permitted. No cargo, wastes or other goods are to be contained in cofferdams.

Fig. R4.5.1-1



6 With respect to the requirements of **4.5.1-2, Part R of the Rules**, cargo sampling lockers may be positioned within the cargo area. However, paint lockers and spaces for the storage of other flammable liquids cannot be located within such area.

7 With respect to the requirements of **4.5.1-3, Part R of the Rules**, lamp rooms, store rooms, paint rooms, locker rooms, etc. independently provided at the bow section which are seldom accessed by persons may be provided in cargo areas other than cargo tanks and slop tanks such as the upper part of the ballast tanks, cofferdams, etc. or ship side adjoining thereto (See **Fig.R4.5.1-3**).

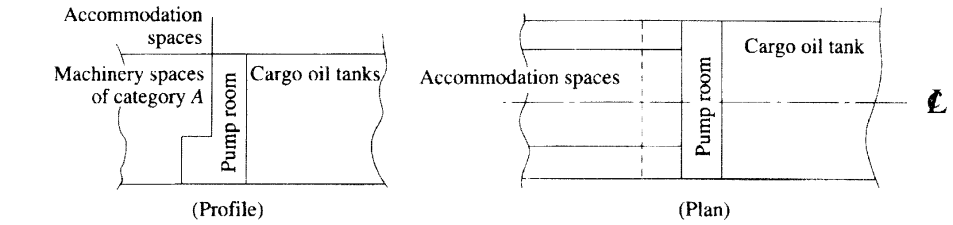
8 The cofferdams specified in **4.5.1-4(1), Part R of the Rules** may be commonly used for permanent ballast tanks.

9 "A permanent continuous coaming of a height of at least 300 *mm*" specified in the requirements of **4.5.1-6, Part R of the Rules** is to be as shown in **Fig.R4.5.1-4** and not to be made lower than 50 *mm* above the upper edge of shear strakes.

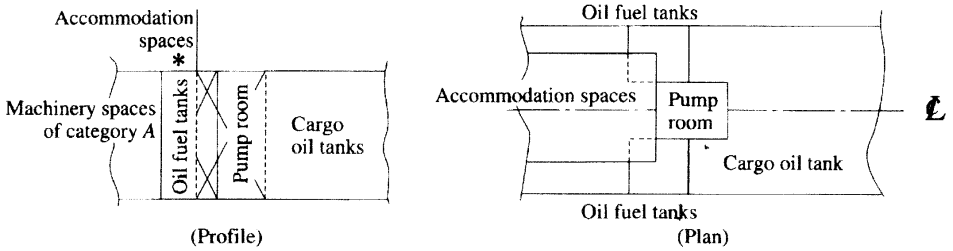
10 As "the arrangements associated with stern loading" specified in the requirements of **4.5.1-6, Part R of the Rules**, foam extinguishers or equivalent are to be provided in addition to the requirements of **14.2.4-4, Part D** and **4.5.2-6, Part R of the Rules**, and further, oil drip pans in sufficient size or spillage coaming are to be provided.

11 An example of the "cargo tank block" defined in **4.5.1-8, Part R of the Rules** is shown in **Fig. R4.5.1-5**.

Fig. R4.5.1-2

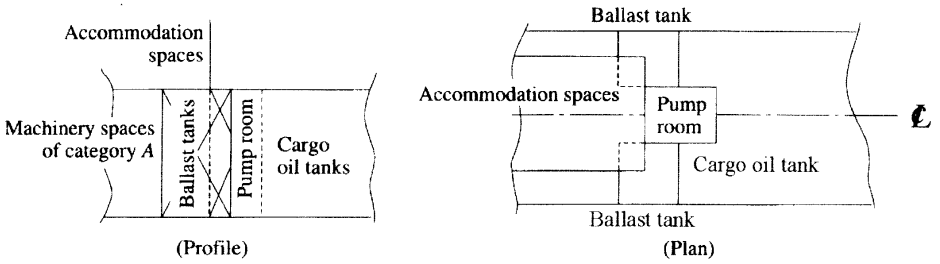


(Acceptable)

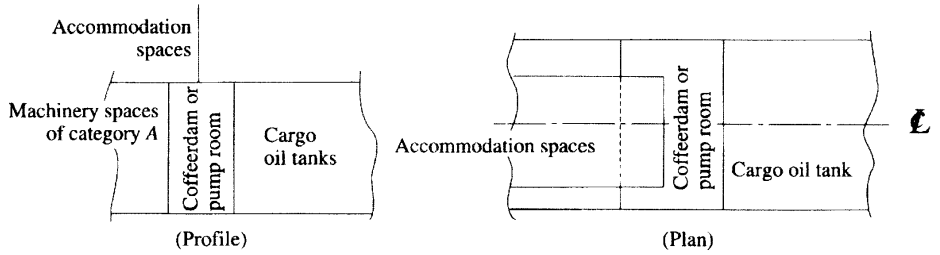


* Consideration should be given to the requirements of 14.3.4 Part C of the Rules.

(Acceptable)

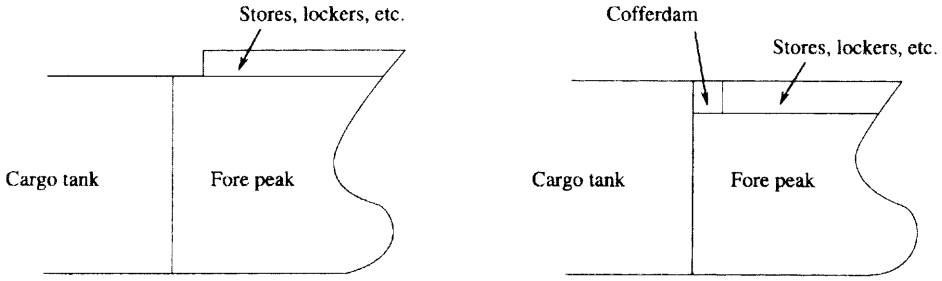


(Acceptable)

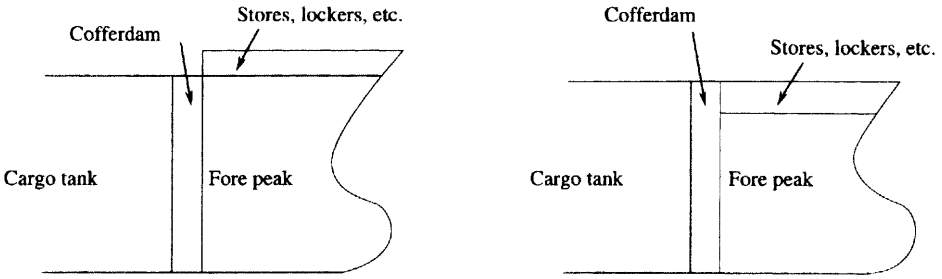


(Not acceptable)

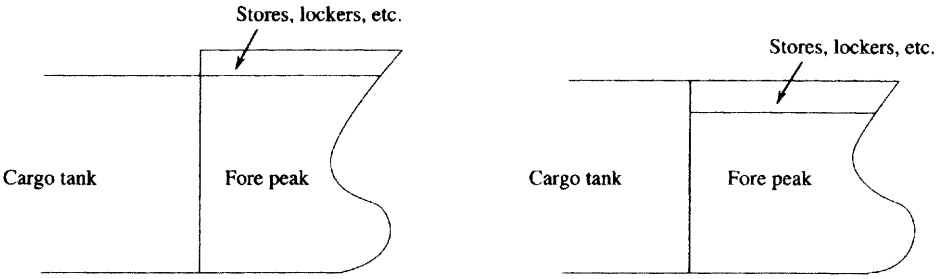
Fig. R4.5.1-3



(Acceptable)



(Acceptable)



(Not acceptable)

Fig. R4.5.1-4

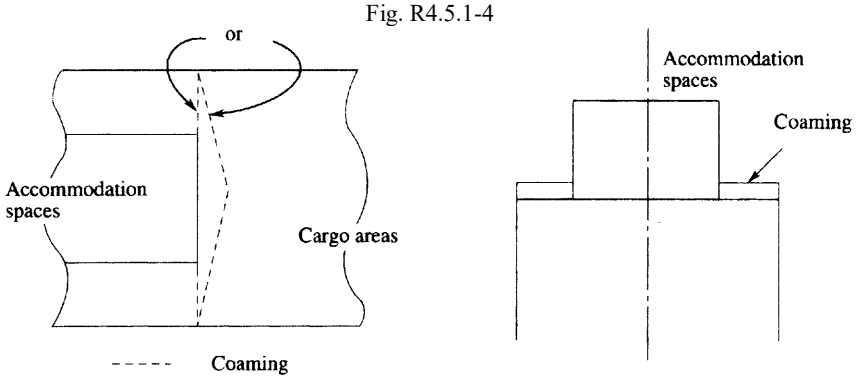
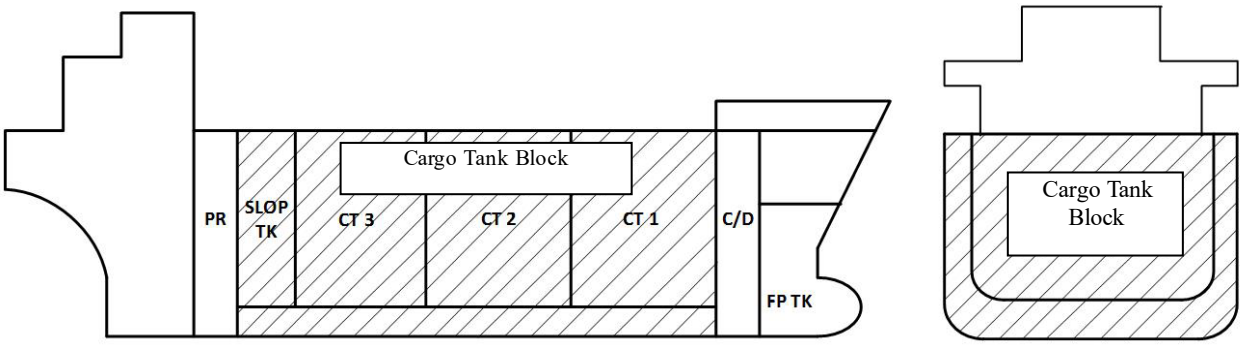


Fig. R4.5.1-5 Example of Cargo Tank Block



SLOP TK : Slop tank
CT1/2/3 : NO.1/2/3 Cargo tank
PR : Cargo pump room
C/D : Cofferdam
FP TK : Forepeak tank

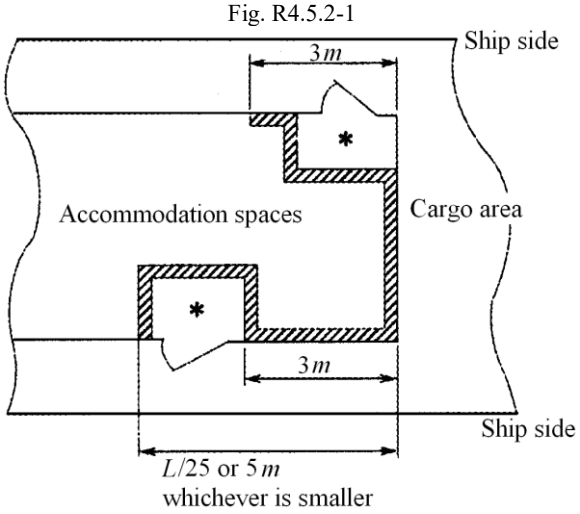
R4.5.2 Restriction on Boundary Openings

1 In cases where it is impossible or impractical to satisfy the requirements specified in **4.5.2-1** and **-2**, access doors, air inlets and openings facing cargo areas may be provided subject to no sources of ignition in a hazardous areas as defined in **4.3.1, Part H of the Rules**. In such cases, explosion-protected electrical equipment complying with *IEC* 60092-502 is not regarded as a source of ignition.

2 With respect to the requirements specified in **4.5.2-1, Part R of the Rules**, thermal insulation of superstructures and deckhouses facing the cargo oil tanks is to be in accordance with the requirements of **R9.2.4-1**.

3 The boundaries of spaces, where "*A*-60" class insulation is required under the requirements of **4.5.2-2, Part R of the Rules**, are to be insulated as exemplified in **Fig.R4.5.2-1**. The ceilings and floors of spaces with asterisk are also to have "*A*-60" class insulation. Incidentally, foam liquid tanks for the deck foam systems may be provided in these spaces.

Fig. R4.5.2-1



4 With respect to the provisions of **4.5.2-2, Part R of the Rules**, an access to a deck foam system room (including the foam tank and the control station) may be permitted within the limits mentioned in **4.5.2-1, Part R of the Rules**, provided that the conditions specified in **4.5.2-2, Part R of the Rules** are satisfied and that door is located flush with the bulkhead.

5 The navigational bridge external doors and windows which are located within the limits specified in **4.5.2-2, Part R of the Rules**, are to be provided with packing and clamping fittings. For ensuring their gas-tightness, appropriate test are to be carried out. If a water hose test is applied, such tests are to be in accordance with the provisions of **An1.4.4-3, Annex 2.1.5 "TESTING PROCEDURES OF WATERTIGHT COMPARTMENTS", Part B of the Rules**.

6 The wording "permanent approved lighting enclosures for illumination with adequate strength and fire integrity and gas-

tightness of the bulkhead or deck" required in **4.5.2-5, Part R of the Rules** means those which have integrity and gastightness equivalent to Grade *A* bronze side scuttles (fixed type) specified in **Chapter 7 of Part L of the Rules** and are fitted with fire resistant glass where illumination is made through a glazed window. However, the bulkheads and decks bounding the cargo pump rooms required to have "*A*-60" class fire protection under the requirements of **Table R9.3** or **Table R9.4**, **Part R of the Rules** are not to be provided with these glazed windows.

R4.5.3 Cargo Tank Venting

1 When a ship carrying dangerous chemical in bulk equipped with controlled tank venting systems complying with **8.2, Part S of the Rules** carries crude oil, oil or other similar liquid cargoes with a vapour pressure less than 0.28 *MPa* absolute at 37.8℃, the mentioned ship may be regarded as a ship complying with the requirements in **4.5.3-1, Part R of the Rules**.

2 "A clear visual indication of the operational status of the valves" specified in **4.5.3-2(2), Part R of the Rules** may be achieved by, for example, a distinguishable valve handle position or a placard showing OPEN /CLOSE condition put up near the valve.

3 The design, arrangement, etc. of devices to prevent the passage of flame (hereinafter referred to as the devices in **R4.5.3**) specified in **4.5.3-3, Part R of the Rules** are to comply with the following requirements.

(1) Terms used in this Chapter are defined as follows.

(a) A device to prevent the passage of flame is a device to prevent the passage of flame through the venting system into the cargo tanks, and includes a flame screen, a flame arrester, a detonation flame arrester and a high velocity device. Such devices are to be of approved type in accordance with the provisions of **Chapter 7, Part 6 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**, or those deemed as equivalent by the Society.

(b) A flame screen is a device to prevent the passage of flame utilizing wire mesh to prevent the passage of unconfined flames.

(c) A flame arrester is a device to prevent the passage of flame utilizing flame arresting element which is based on the principle of quenching.

(d) A detonation flame arrester is a device to prevent the passage of flame generated in association with the detonation in the pipe line.

(e) A high velocity device is a device to prevent the passage of flame consisting of a mechanical valve which adjusts the opening available for flow in accordance with the pressure at the inlet of the valve in such a way that the efflux velocity cannot be less than 30 *m/s*.

(f) Flame speed is the speed at which flame propagates along a pipe or other system.

(g) Flash back is the transmission of flame through a device to prevent the passage of flame.

(2) The device is to be fitted according to the respective types at such a position that the passage of flame through the openings specified in the followings into the cargo tanks can be prevented. Notwithstanding the above, the devices to be fitted in a venting system for cargo oil tanks protected against a flammable condition by an inert gas system complying with **Chapter 35, Part R of the Rules**, may be of a type for which an endurance burning test is dispensed with.

(a) A flame screen, a flame arrester or a detonation flame arrester is to be fitted at the following openings:

i) Air suction inlets, through which vapours cannot be vented to atmosphere, of the venting system for preventing the vacuum in the tanks by thermal variations specified in **11.6.1(1), Part R of the Rules**

ii) Air suction inlets, through which vapours cannot be vented to atmosphere, of the venting system for preventing the vacuum in the tanks during cargo unloading specified in **11.6.1(2), Part R of the Rules**

iii) Discharge outlets for cargo tank purging/gas-freeing in ships not provided with an inert gas system, specified in **16.3.2-2(3), Part R of the Rules**

(b) A flame arrester, a detonation flame arrester or a high velocity device is to be fitted for the following openings:

i) Openings for release of pressure by thermal variations specified in **11.6.2, Part R of the Rules**

ii) Vent outputs specified in **4.5.3-4(1)(c), Part R of the Rules**, including discharge outlets for cargo tank purging/gas-freeing in ships not provided with an inert gas system other than those specified in **(a)iii)** or **(c)** above.

(c) A high velocity device is to be fitted for vent outlets for cargo tanks specified in **4.5.3-4(1)(d), Part R of the Rules**.

(3) The arrangement and installation of the devices are to be in accordance with the following requirements:

(a) The devices are to be fitted at the outlets to atmosphere unless tested and approved for in-line installation. The devices for in-line installation are not to be fitted at the outlets to atmosphere unless they have been tested and approved for that position.

(b) In case where a detonation flame arrester is installed, the distance between the detonation flame arrester and the end of pipes in which it is fitted is to be such that neither stationary flames nor overheats leading to flash back be generated.

(c) The devices are to be secured in openings so that flames cannot circumvent the devices.

(4) A means is to be provided to prevent the devices from freezing if the operation of the devices is likely hindered by the freezing.

(5) A means is to be provided to enable a personnel to have an access to the devices fitted more than 2 *m* above the deck to facilitate maintenance, repair and inspection.

(6) An instruction manual which includes the followings is to be kept on board the ship.

(a) Installation instructions (including items specified in **(3)** through **(5)** of **R11.6.3-5** and items relating to the restrictions of installation of pipes, cowls, weather hoods, deflectors, etc.)

(b) Operating instructions

(c) Maintenance instructions including the following items:

i) Information on maintenance of any corrosion prevention system.

ii) Instructions on the timing and method of cleaning.

iii) Instructions clearly defining the method of setting the pressure, dismantling and reassembling the devices, numbering and ordering of the parts, and diagrams for proper assembly of the devices.

iv) For the *PV* valves, instructions to check the valve lift by the user prior to each cargo loading and cargo unloading.

(d) A copy of the test record including the following items:

i) Detailed drawings of the device

ii) Test items carried out with their results (the maximum pressure and velocity observed are to be included in case of devices for in-line installation)

iii) Special advice on approved attachments

iv) Types of cargo for which the device is approved

v) Drawings of the test apparatus

vi) The pressure at which the device opens and closes in case of high velocity devices

vii) All information marked on the device

(e) Flow test data, including flow rates under both positive and negative pressure, operating sensitivity, flow resistance and velocity

(f) The manufacturer's certification

4 With respect to the provisions of **4.5.3-3, Part R of the Rules**, ullage openings need not include cargo tank openings that are fitted with standpipe arrangements used for sampling, monitoring, measuring or etc., with its own manually operated shutoff valves and diameter of which is not grater than 50 *mm*.

5 The area around the vent outlets specified in **4.5.3-4(1)(c)** and **(d)**, **Part R of the Rules** is defined as a hazardous area in accordance with *IEC* 60092-502:1999.

(1) Areas on open deck, or semi-enclosed spaces on open deck, within a vertical cylinder of unlimited height and 6 *m* radius upon the centre of the outlet, and within a hemisphere of 6 *m* radius below the outlet which permit the flow of large volumes of vapour, or gas mixtures during loading, discharging, or ballasting are defined as Zone 1 as specified by *IEC* 60092-502:1999 para 4.2.2.8.

(2) Area within 4 *m* beyond the zone specified in **(1)** above are defined as Zone 2 as specified by *IEC* 60092-502:1999 para 4.2.2.8.

(3) Electrical equipment or cables are not normally to be installed in hazardous areas. Where essential for operational purposes, electrical equipment may be installed in accordance with *IEC* 60092-502:1999 (*see* **4.2.4, Part H**).

(4) Electrical equipment fitted in compliance with *IEC* 60092-502:1999 is not considered as a source of ignition or ignition hazard (*see* **4.2.4, Part H**).

R4.5.4 Ventilation

1 With respect to the requirements of **4.5.4-1(1), Part R of the Rules**:

(1) For minimizing possible accumulation of the flammable vapours, the ducts are to be arranged, to permit ventilation in the vicinity of the cargo oil pump room bilge, above the floor plate or bottom longitudinals. An emergency intake located nearly 2 *m* above the cargo oil pump room lower grating is to be arranged for the ducts, and this emergency intake is to have a damper which is capable of being opened or closed from the weather deck and lower grating level. When the lower inlets are closed, at

least 15 air changes per hour are to be obtained through the upper inlets.

(2) The ventilation fan of non-sparking construction is to be as follows:

(a) The ventilation fan of non-sparking construction means fans of which materials used for impellers and/or housings are regarded as having a non-sparking property in accordance with **Table R4.5.4-1** and of which blade tip clearance is at least 10% of the shaft diameter but need not be more than 13 *mm* (minimum 2 *mm*). Those specified in this **(a)** also apply to the portable blower fans used outside the cargo pump room.

(b) Notwithstanding the requirements specified in **(a)** above, fans for which non-sparking property test is carried out in the presence of the Surveyor with satisfactory results may be considered as a non-sparking type. This test may be omitted for fans having test results considered as appropriate by the Society.

(c) Where non-metal materials are used, the anti-electrostatic property is to be verified by a method considered as appropriate by the Society. Fans of which electrical leakage resistance (insulation resistance to earth) is less than 1×10^6 Ω or electrical conductivity is not less than 1×10^8 *S/m* may be regarded as having an anti-electrostatic property.

(d) Ventilation fans are to be earthed effectively with the hull.

(3) The wording "mesh of suitable size" for wire mesh screens means a mesh not exceeding 13 *mm* × 13 *mm*.

2 The wording "the wire gauze to prevent the passage of flame" specified in **4.5.4-1(2), Part R of the Rules** means the one specified in **D14.3.2-3 (1)**.

3 With respect to the requirements of **4.5.4-2, Part R of the Rules**, vent pipes for slop tanks are to be led to a suitable position in the open air so as to preclude any danger in case where oil having a flash point not exceeding 60℃ is carried therein when the ship is in the dry cargo mode.

Table R4.5.4-1 Materials Used for Ventilation Fans in Cargo Oil Pump Room

Materials of housing or Materials of lining with a satisfactory thickness	Materials of impellers			
	Nonmetallic material with anti-electrostatic property	Ferrous materials (including austenitic stainless steel)	Non-ferrous materials	
				Aluminium alloys or magnesium alloys
Nonmetallic material with anti-electrostatic property	*A*	*A*	*A*	*A*
Ferrous materials (including austenitic stainless steel)	*A*	*D*	*B*	*C*
Non-ferrous materials	*A*	*B*	*A*	*A*
Aluminium alloys or magnesium alloys	*A*	*C*	*A*	*A*

Note:

A : Combinations considered as having a non-sparking property. (In case of nonmetallic materials, the anti-electrostatic property is to be verified in accordance with **R4.5.4-1(2)(c)**.)

B : Combinations to be approved by the Society. (Non-sparking property tests are to be carried out except for the combination of beryllium copper alloy and brass which is regarded as having a non-sparking property.)

C : Combinations considered as having a sparking property. This combination can not be used.

D : Combinations considered as having a non-sparking property, provided that the impeller tip clearance is at least 13 *mm*.

R4.5.5 Inert Gas Systems

1 The wording "means to prevent hydrocarbon gases from the cargo tanks entering the double hull spaces through the system" specified in **4.5.5-3(2), Part R of the Rules** means that the branch lines for the supply of inert gas into the double hull spaces are connected to the position between the inert gas regulating valves specified in **35.2.3(1)(b)i) of the Rules** and the non-return devices specified in **35.2.2-3(1)(b), Part R of the Rules** or equivalent measures, and are fitted with the non-return devices in addition to the non-return devices required in **35.2.2-3(1)(b), Part R of the Rules** to prevent hydrocarbon gases from the polluted double hull spaces entering machinery spaces or other safety spaces.

2 The wording "appropriate means" specified in **4.5.5-3(3), Part R of the Rules** means the arrangement which consists of portable pipes or flexible hoses and blanking flanges. Portable pipes or flexible hoses are to be removed and kept on board and all openings of connections of the inert gas main and double hull spaces are to be fitted with blanking flanges except in the event of leakage of oil from cargo oil tanks entering double hull spaces.

3 The wording "the guidelines deemed appropriate by the Society" specified in **4.5.5-4(1), Part R of the Rules** means the "*Regulation for Inert Gas Systems on Chemical Tankers*" (*Res.A*.567(14)) , and Corr.1. With respect to this requirement, the following **(1)** and **(2)** are to be applied.

(1) An automatic control capable of producing suitable inert gas under all service conditions is to be fitted.

(2) Portable instruments for measuring oxygen and flammable vapour concentration required by Regulation 15 of *Res.A*.567(14) may be utilized as those required by **4.5.7(1), Part R of the Rules**, however, flammable vapour in an inerted atmosphere can be measured.

4 With respect to the wording "the satisfaction of the Society" specified in **4.5.5-9, Part R of the Rules**, the following **(1)** through **(4)** are to be complied with.

(1) Materials used in inert gas systems are to be suitable for their intended purpose.

(2) With respect to inert gas systems using nitrogen generators, the following **(a)** and **(b)** are to be complied with.

(a) **35.2.2-2(2)**, **35.2.2-2(4)**, **35.2.2-4(2)**, **35.2.2-4(3)**, **35.2.2-4(5)(a)** (except **(a)iii)** through **v)**), **35.2.2-4(5)(d)**, **35.2.4(1)(c)**, **35.2.4(1)(d)**, **35.2.4(1)(f)**, **35.2.4(1)(g)**, **35.2.4(1)(h)**, **35.2.4(1)(i)**, **35.2.4(1)(j)** and **35.2.4(2), Part R of the Rules** are to be complied with.

(b) The two non-return devices as required by **35.2.2-3(1)(a), Part R of the Rules** are to be fitted in the inert gas main. The non-return devices are to comply with **35.2.2-3(1)(b)** and **35.2.2-3(1)(c), Part R of the Rules**, however, where the connections to the cargo tanks, to the hold spaces or to cargo piping are not permanent, the non-return devices required by **35.2.2-3(1)(a), Part R of the Rules** may be substituted by two non-return valves.

(3) Inert gas systems using flue gases are to comply with the requirements of **Chapter 35, Part R of the Rules** except the provisions of **35.2.2-1(2)(d)**, **35.2.3(1)(a)i)**, **35.2.3(1)(c)i)**, **35.2.3(1)(d)i)** and **35.2.3(1)(d)iii), Part R of the Rules**.

(4) Inert gas systems using boiler exhaust gas are to comply with the requirements of **Chapter 35, Part R of the Rules** except the provisions of **35.2.2-1(2)(d)**, **35.2.3(1)(a)i)**, **35.2.3(1)(c)i)**, **35.2.3(1)(d)i)** and **35.2.3(1)(d)iii), Part R of the Rules**.

5 The wording "double hull spaces" specified in **4.5.5-3(1), Part R of the Rules** means 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, except cargo pump-rooms and ballast pump rooms. The expressions "tanks" and "spaces" are in accordance with **R4.5.7-5** through **-7**.

R4.5.6 Inerting, Purging and Gas-freeing

"Gas-free" specified in **4.5.6-1, Part R of the Rules** means a condition in a tank where the content of hydrocarbon or other flammable vapour is less than 1% of the lower flammable limit (*LFL*), the oxygen content is at least 21%, and no toxic gases are present.

R4.5.7 Gas Measurement

1 The portable instruments for measuring flammable vapour and oxygen concentrations required in **4.5.7(1), Part R of the Rules** may be utilized as portable instruments required in **4.5.7(2)(a), Part R of the Rules**.

2 The wording "suitable means are to be provided for the calibration of such instruments" in **4.5.7(1)(a), Part R of the Rules** refers to portable instruments for measuring flammable vapour and oxygen concentrations being calibrated on board or ashore in accordance with the manufacturer's instructions together with corresponding calibration records being kept. In this regard, the calibration of portable instruments for measuring flammable vapour and oxygen concentrations does not include any pre-operational accuracy tests as recommended by the manufacturer.

3 The provisions on the number of portable instruments and spares for measuring flammable vapour and oxygen concentrations required by **4.5.7(1), Part R of the Rules** are to be satisfied in either of the following ways:

(1) a minimum of two instruments are provided on board, including spares, in cases where each is capable of measuring both oxygen and flammable vapour concentrations.

(2) at least two of each, including spares, are provided on board in cases where separate portable instruments are respectively used to measure such concentrations.

4 The wording "deemed appropriate by the Society" in **4.5.7(1)** and **(2), Part R of the Rules** means to be approved by the Society

in accordance with **Chapter 7, Part 7 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use** or to pass the test of the official organization deemed appropriate by the Society.

5 The words "cargo tanks" in the phrase "spaces adjacent to the cargo tanks" in **4.5.7(3)(a), Part R of the Rules** includes slop tanks except those arranged for the storage of oily water only.

6 The word "spaces" in the phrase "spaces under the bulkhead deck adjacent to cargo tanks" in **4.5.7(3)(a), Part R of the Rules** includes dry compartments such as ballast pump-rooms and bow thruster rooms and any tanks such as freshwater tanks, but excludes fuel oil tanks.

7 The word "adjacent" in the phrase "adjacent to the cargo tanks" in **4.5.7(3)(a), Part R of the Rules** includes ballast tanks, void spaces, other tanks or compartments located below the bulkhead deck located adjacent to cargo tanks and includes any spaces or tanks located below the bulkhead deck which form a cruciform (corner to corner) contact with the cargo tanks.

R4.5.10 Protection of Cargo Pump-rooms

1 With respect to the requirements of **4.5.10(2), Part R of the Rules**, a caution plate giving that the lighting is interlocked with ventilation is to be provided nearby switches for the lighting. Where the lighting in cargo pump-rooms can be commonly used as the emergency lighting, this lighting may be accepted for use as emergency lighting and, therefore, interlock devices with ventilation systems may be omitted.

2 The continuous monitoring system for the concentration of hydrocarbon gases required in **4.5.10(3), Part R of the Rules** is to be in accordance with the followings:

(1) The system may be of a sampling type provided that the system is dedicated for cargo pump rooms. In this case, a sampling period is to be as short as possible. Where a gas analysing unit with non-explosion proof measuring equipment is provided for the system, the unit may be located in areas outside cargo areas, e.g. in the cargo control room, navigation bridge or engine room when mounted on the forward bulkhead provided that the following requirements are observed:

(a) Sampling lines are not to run through gas safe spaces (Gas safe spaces mean spaces in which the entry of hydrocarbon vapour would produce hazards with regard to flammability or toxicity. The same is referred hereinafter.), except where permitted under **(e)**.

(b) The gas sampling pipes are to be provided with devices to prevent the passage of flame. The sample gas is to be led to the atmosphere with outlets provided with devices to prevent the passage of flame and arranged in a safe location.

(c) Flame arresters and flame screens complying with the requirements of **R4.5.3-3** are to be provided for sampling lines and discharge gas lines from gas analysing units, respectively, as the "devices to prevent the passage of flame" specified in **(b)** above.

(d) In respect of the provisions of **(b)** above, the "safe location" for the arrangement of discharge outlets is to be at a horizontal distance not less than 3 *m* from the nearest air intake, discharge outlet or opening to accommodation spaces, service spaces and control stations, or other non-hazardous locations.

(e) Bulkhead penetrations of sample pipes between safe and dangerous areas are to have the same fire integrity as the division penetrated by an equivalent construction or fittings to those specified in **R9.3**. A manual isolating valve is to be fitted in each of the sampling lines at the bulkhead on the gas safe side.

(f) The gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc. is to be located in a reasonably gas tight enclosure (*e.g.* a fully enclosed steel cabinet with a gasketed door) which is to be monitored by its own sampling point. At gas concentrations above 30% *LFL* inside the steel cabinet the entire gas analysing unit is to be automatically shut down.

(g) Where the enclosure cannot be arranged directly on the bulkhead, sample pipes are to be of steel or other equivalent materials and without detachable connections, except for the connection points for isolating valves at the bulkhead and analysing units, and are to be routed on their shortest ways. Copper pipes may be used for sample pipes as equivalent.

(h) A visual and audible alarm is to be provided to notify the shut down of the gas analysing unit specified in **(f) above**. The alarm signal is to be provided in the cargo control room and navigation bridge.

(2) For the system, a flammable gas detecting system suitable for detection of vapours from loaded cargoes may be accepted.

3 The wording "suitable positions in order that potentially dangerous leakages are readily detected" specified in **4.5.10(3), Part R of the Rules** means the zone where air circulation is reduced (*e.g.* recessed corners).

4 The wording "as deemed appropriate by the Society" in **4.5.10(3), Part R** of the Rules is to be followed as given in **R4.5.7-4**.

5 The wording "appropriately located alarms" specified in **4.5.10(4), Part R of the Rules** means alarms activating at a level of sufficiently lower than the stuffing box.

6 With respect to the requirements of **4.5.10(4), Part R of the Rules**, a bilge high level alarm system being capable of detecting a small bilge in the cargo pump room and alarming to the cargo control room or the cargo pump control station may be regarded as a bilge level monitoring system.

R5 FIRE GROWTH POTENTIAL

R5.2 Control of Air Supply and Flammable Liquid to the Space

R5.2.1 Closing Appliances and Stopping Devices of Ventilation

1 With respect to the requirements of **5.2.1-1, Part R of the Rules**, the provision of closing appliances for the ventilation of battery rooms may be exempted, subject to the following **(1)** to **(3)**:

(1) The battery room only opens directly onto an exposed deck;

(2) The height of the ventilation opening for the battery room above the deck is not less than 4.5*m* in the position I and not less than 2.3 *m* in the position II specified in **1.4.3.2, Part 1, Part C of the Rules**; and

(3) The battery room is not fitted with a fixed gas fire-extinguishing system.

2 In cases where a closing appliance is provided for the ventilation of a battery room, a warning notice stating , for example "This closing device is to be kept open and only closed in the event of fire or other emergency - Explosive Gas", is to be provided near the closing appliance mitigate the possibility of inadvertent closing.

3 With respect to the requirements of **5.2.1-2, Part R of the Rules**, the fan in a HVAC temperature control unit, or a circulation fan inside a cabinet/switchboard, is not considered to be a ventilation fan, if it is not capable of supplying outside air to the space (e.g., small units intended for re-circulation of air within a cabin). Therefore, such fans need not be capable of being stopped from an easily accessible position outside the space being served.

R5.2.2 Means of Control in Machinery Spaces

1 The means of control outside the space concerned required in **5.2.2, Part R of the Rules** may be provided in corridors. In this case, it is not necessary to regard such corridors as the control station.

2 With respect to the provisions of **5.2.2-3, Part R of the Rules**, these requirements need not apply to cargo pumps other than those for flammable liquid cargoes. Where submersed pumps are used for cargo pumps, spaces above cargo tanks they serve are not to be regarded as a space where the means of control will not be cut off in the event of fire in the cargo tanks.

R5.3 Fire Protection Materials

R5.3.1 Use of Non-combustible Materials

1 In accommodation spaces, service spaces and control stations, details of fire protection materials are shown in **Annex R5.3.1-1 "Details of Fire Protection Materials".**

2 The wording "cold service systems" stipulated in **5.3.1-1, Part R of the Rules** means refrigeration systems and chilled water piping for air-conditioning systems.

3 With respect to **5.3.1-2, Part R of the Rules**, grounds, gratings, linings, ceilings, and internal divisions with associated doors used in refrigerated compartments may not be required to be of non-combustible materials.

4 Not withstanding the requirements specified in **5.3.1-2, Part R of the Rules**, vibration damping rubber may be used unless it forms a part of the structural integrity

R5.3.2 Use of Combustible Materials

1 The "calorific value" specified in **5.3.2-2, Part R of the Rules** is to be measured in accordance with *ISO* 1716:2010 "Reaction to fire tests for building products - Determination of the heat of combustion".

2 With respect to the wording "combustible materials recognized to have low flame spread characteristics" as specified in **5.3.2-4, Part R of the Rules**, combustible veneers are called as "fire retardant veneers" and the other combustible base materials are called as "fire retardant base materials".

3 The wording "concealed spaces or inaccessible spaces" specified in **5.3.2-4(2), Part R of the Rules** means the spaces in the rear side of ceilings, spaces between lining and shell plating, spaces in double-plated bulkheads and other similar spaces.

R6 SMOKE GENERATION POTENTIAL AND TOXICITY

R6.2 Finishes

R6.2.1 Paints, Varnishes and Other Finishes

1 The wording "exposed interior surfaces" specified in **6.2.1, Part R of the Rules** means the surfaces exposed to accommodation spaces, services spaces, control stations and machinery spaces in addition to the surfaces of corridors and stairway enclosures exposed to accommodation spaces, services spaces, control stations and machinery spaces (other than the exposed surfaces specified in **5.3.1-1, Part R of the Rules** or the exposed surfaces of finishes used in similarly small spaces).

2 The wording "other finishes" specified in **6.2.1, Part R of the Rules** means those combustible flooring of deck covering and combustible veneers applied on surfaces of bulkheads, linings and ceilings. However, those surface materials used for handrailing, moulding and non-skid strips of stairs or other surface materials used only for equally small areas of application may not be required to satisfy these requirements.

3 "Paints, varnishes and other finishes used on interior exposed surfaces" specified in **6.2.1, Part R of the Rules** are to comply with the requirements of **5.3.2-4, Part R of the Rules**.

R6.3 Primary Deck Coverings

R6.3.1 Primary Deck Coverings

With respect to the wording "primary deck coverings" specified in **6.3.1, Part R of the Rules**, reference is made to **R4.4.4**.

R7 DETECTION AND ALARM

R7.2 General Requirements

R7.2.1 Fixed Fire Detection and Fire Alarm System

The wording "fixed fire detection and fire alarm system of an approved type" specified in **7.2.1, Part R of the Rules** means the systems which are approved by the Society or organizations deemed appropriate by the Society.

R7.4 Protection of Machinery Spaces

R7.4.1 Installation

1 Requirements of **7.4.1-1, Part R of the Rules** may apply to machinery spaces of category *A*.

2 In case where control rooms are provided in the machinery spaces for the control of the main propulsion machinery and related auxiliaries (including the main sources of power supply), such machinery spaces are to be regarded as the machinery spaces specified in **7.4.1-1(3), Part R of the Rules**.

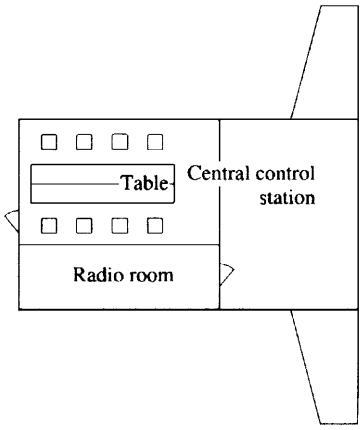
R7.5 Protection of Accommodation and Service Spaces and Control Stations

R7.5.1 Fire Detection and Fire Alarm Systems

1 With respect to the requirements of **7.5.1, Part R of the Rules**, the deckhouses, boatswain's lockers, etc. which are separated from accommodation spaces may not be deemed as service spaces.

2 In case where the central control station is arranged as shown in **Fig. R7.5.1-1**, the spaces of such control stations which can be regarded as the service spaces are to be provided with the fire detection system conforming to the requirements of **Chapter 29, Part R of the Rules** and the space of such control stations which can be regarded as the navigation bridge is to be provided with manual call points. However, in case where a general alarm system is provided, such manual call points are not necessary.

Fig. R7.5.1-1



3 With respect to the requirement of **7.5.1, Part R of the Rules**, unless otherwise specified in **-2** above, control stations need not be covered by a fixed fire detection and fire alarm system.

R7.5.2 Manually Operated Call Points

1 The wording "Manually operated call points are to be installed throughout the accommodation spaces, service spaces and control stations." specified in **7.5.2, Part R of the Rules** means that 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" as specified in the same paragraph and, in addition, are to be installed at:

(1) each exit to the open deck from the corridor; and

(2) a location within 20 *m* (measured along the access route using the deck, stairs and/or corridors) from the exit of service spaces and control stations which have only one access, leading directly to the open deck.

2 Not withstanding the provisions in **-1** above, manually operated call points do not need to be installed at:

(1) spaces having little or no fire risk, such as voids and carbon dioxide rooms; and

(2) the navigation bridge where the control panel is located.

R7.6 Protection of Cargo Spaces

R7.6.1 Fire Detection and Fire Alarm Systems

The wording "any cargo spaces which can not be readily accessed" specified in **7.6.1, Part R of the Rules** means the cargo spaces which can not be accessed due to the cargoes on deck or of which inside condition can not be ascertained through the cargo or access hatches.

R8 CONTROL OF SMOKE SPREAD

R8.2 Protection of Control Stations

R8.2.1 Protection of Control Stations Outside Machinery Spaces

1 As the "practicable equipment to ensure that ventilation, visibility and clearing of smoke are maintained" for control stations outside the machinery spaces specified in **8.2.1, Part R of the Rules**, mechanical ventilation system is preferable, but natural ventilation system may also be accepted.

2 The wording "where local closing arrangements would be equally effective" specified in **8.2.1, Part R of the Rules** means that fire dampers or smoke dampers which are easily closed within the control stations are provided in the ventilation system so that smoke would not be drawn into such a control station in case of fire, and further, any openings, where provided, can be easily and securely closed.

3 With respect to the requirement of **-2** above, smoke dampers are to be accordance with **(1)** and **(2)** below:

(1) Smoke dampers are to be constructed of steel or other equivalent materials.

(2) Smoke prevention performance is to be verified by manufacturers, etc., and related documents regarding smoke prevention performance are to be submitted to the Society.

R8.3 Release of Smoke

R8.3.1 Release of Smoke from Machinery Spaces

1 The arrangements to release smoke from machinery spaces including its control system specified in **8.3.1, Part R of the Rules** are to comply with the following requirements **(1)**, **(2)** and **(3)**:

(1) The arrangements to release smoke from machinery spaces are to be skylights, natural ventilation system provided at the crown of machinery spaces, mechanical exhaust ventilating fans and other proper means.

(2) In place of the mechanical exhaust ventilating fans given in **(1)** above, reversible mechanical ventilating fans may be accepted. In this case, however, it is to be ensured that the mechanical ventilating fans can be started/stopped at the position specified in **8.3.1-3, Part R of the Rules**.

(3) In case where an emergency generator is provided on board the ship, it is preferable that the ventilation system to release smoke can be operated by the emergency power supply.

2 The means of control required in **8.3.1-3, Part R of the Rules** may be provided in corridors. In this case, it is not necessary to regard such corridors as the control station.

R8.4 Draught Stops

R8.4.1 General

"Draught stops" stipulated in **8.4.1, Part R of the Rules** are to be of the followings.

(1) Construction of draught stops is to comply with the standard given in any of the following **(a)** to **(e)**. Other equivalent arrangements may be accepted.

(a) The extension of the "*B*" class bulkhead, ceiling or lining

(b) The extension of the "*C*" class bulkhead, ceiling or lining

(c) Minimum 1 *mm* thick steel sheet, stiffened where necessary, intermittently welded to the ship's structure and the top profile of the bulkhead, or fastened mechanically to the ceilings or linings.

(d) Non-combustible material board fastened mechanically to the ship's structure, bulkheads, ceilings or linings.

(e) "*A*" class mineral wool insulation, not less than 20 *mm* in thickness, faced on each side with expansible metal mesh, either of which is attached to the ship's structure, or faced on one side with expansible metal mesh and on the other side with non-combustible cloth (glass-cloth).

(2) In general, the draught stops are to coincide with the bulkheads where continuous ceiling are used.

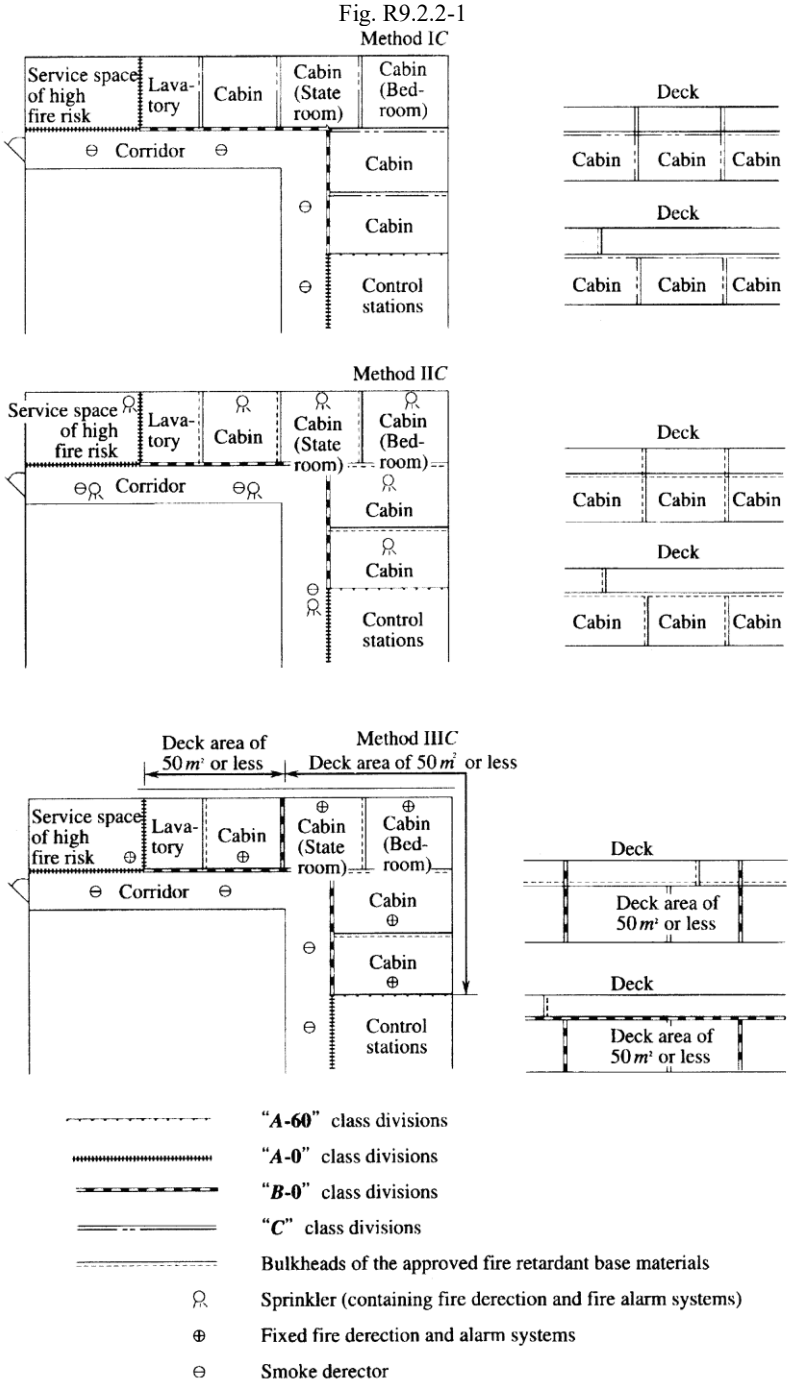
R9 CONTAINMENT OF FIRE

R9.2 Thermal and Structural Boundaries

R9.2.2 Methods of Protection

1 As for the methods of divisions and protections for accommodation spaces and service spaces for complying with the requirements specified in **9.2.2-1, Part R of the Rules**, the standard arrangements are shown in **Fig. R9.2.2-1**.

Fig. R9.2.2-1



2 The wording "all spaces in which fire might be expected to originate" specified in **(2)** and **(3)** of **9.2.2-1, Part R of the Rules** means the spaces excluding those void spaces and sanitary spaces which are intrinsically free from fire risks. In this case, the wording

"sanitary space" means lavatories, bath rooms, shower rooms, laundries, etc.

3 "Increase in area of public rooms" specified in the provision of **9.2.2-1(3), Part R of the Rules** is, in principle, to be limited to 75 m^2.

R9.2.3 Bulkheads and Decks

1 Where spaces are classified for the application of the standards of fire integrity, the requirements specified in **(1)** to **(11)** of **9.2.3-2, Part R of the Rules** and further the requirements given in **Table R9.2.3-1** are also to be complied with. With respect to the provisions of **9.2.3-2, Part R of the Rules**, the wording "smaller, enclosed room" means a room having no entrance to corridors but only therefrom and where someone may occupy during a significant time (*e.g.*, a bed room in a cabin), and the wording "less than 30% communicating openings" means that the total area of the entrance mentioned above is less than 30% of the area of separating bulkheads or divisions. In this connection, lavatories for control stations, only having entrance therefrom, whose area is less than 30% of the area of divisions, may be regarded as an integral part of such spaces.

2 The means of control required under the requirements of **Part R** are, in principle, to be provided in the wheel house or other control stations. If there is no other alternative but to provide in corridors, the corridors are also regarded as the control stations. However, the corridors where the means of control required in **5.2.2**, **8.3.1** or **9.5.2-3, Part R of the Rules** are provided, are not regarded as the control station.

3 The wording "a stairway which is enclosed only at one level" specified in **9.2.3-2(4), Part R of the Rules** means, for example, a stairway connecting provisional stores with galley directly and having only one door, and excepts a stairway connecting a passage with a passage in other floor.

4 With respect to the requirements specified in **(8)** and **(11)** of **9.2.3-2, Part R of the Rules**, ventilating fan rooms within refrigerated cargo spaces and cargo handling gear locker which can be accessible only from ro-ro spaces or vehicle spaces may be regarded as a part of cargo spaces and ro-ro spaces or vehicle spaces respectively.

5 With respect to the requirements specified in **Table R9.1, Part R of the Rules**, in case where two service spaces contiguous to each other both having high fire risk are used for the common purpose, the spaces, as a whole, are to be regarded as one service space of high fire risk. In this case, the bulkheads within the spaces may be of "*C*" class divisions. The wording "common purpose" stated above means either of the following:

(1) Galleys and pantries containing cooking appliances

(2) Paint rooms and lamp rooms

(3) Lockers and store rooms (including the handling spaces)

(4) Workshops (excluding spaces forming a part of machinery spaces)

6 With respect to the requirements specified in **Table R9.1, Part R of the Rules**, "*A*" class bulkheads approved under the condition that the insulated side of such bulkheads are to be exposed spaces identified as fire hazards, may be used only for the following bulkheads **(1)** to **(3)**. In such cases, insulation shall be fitted on the fire hazard side. However, such "*A*" class bulkheads may be used for bulkheads other than those given in **(1)** to **(3)** in cases where deemed appropriate by the Society.

(1) "*A*-60" class bulkheads

  (a) Accommodation spaces [Fire hazard side] and Control stations

  (b) Machinery spaces of category *A* [Fire hazard side] and Control stations

  (c) Machinery spaces of category *A* [Fire hazard side] and Corridors

  (d) Machinery spaces of category *A* [Fire hazard side] and Stairways

  (e) Machinery spaces of category *A* [Fire hazard side] and Service spaces (low risk)

  (f) Service spaces (high risk) [Fire hazard side] and Control stations

(2) "*A*-30" class bulkheads

  Ro-ro and vehicle spaces [Fire hazard side] and Stairways

(3) "*A*-15" class bulkheads

  (a) Service spaces (low risk) [Fire hazard side] and Control stations

  (b) Other machinery spaces [Fire hazard side] and Control stations

7 With respect to the requirements of **9.2.3-2, Part R of the Rules**, deckhouses, boatswain's stores, etc. which are independently arranged away from a group of accommodation spaces may be regarded as independent service spaces respectively. Accordingly, internal divisions in these spaces may be of "*C*" class.

8 (Deleted)

9 The wording "other machinery spaces having little or no fire risk" referred to in footnote *i* of **Table R9.2, Part R of the Rules** means auxiliary machinery spaces which have little or no possibility of spreading fire due to a fire within machinery spaces of category *A* and do not contain any machinery having a pressure lubrication system, such as: fan rooms, ventilation and air-conditioning machinery rooms; windlass room; steering gear room; stabilizer equipment room; electrical propulsion motor room; hydraulic system store rooms; rooms containing section switchboards and purely electrical equipment other than oil-filled electrical transformers (about 10 *kVA*); shaft alleys and pipe tunnels; spaces for pumps and refrigeration machinery (not handling or using flammable liquids).

10 With respect to the requirements of **9.2.3-3, Part R of the Rules**, continuous "*B*" class ceilings or linings may be regarded as a part of insulation of "*A*" class decks or bulk heads.

11 With respect to the requirements of **9.2.3-4, Part R of the Rules**, the doors fitted on the external boundaries may be of any materials. However, in case that the doors are provided in way of the spaces except those having a low risk of fire, such as corridors, stairways, sanitary spaces, void spaces, etc. and located near the places used for the stowage, launching and boarding of lifeboats or life rafts, the materials of them are to be of steel or equivalent.

12 Trunks for dumb-waiters are to be dealt with in the same manner as in lift trunks specified in **9.2.3-6(1), Part R of the Rules**.

13 Stairway penetrating more than a single deck specified in **9.2.3-6(1), Part R of the Rules** are to be protected in accordance with the following requirements:

(1) In case where stairways and passage are provided in stairway enclosures and access to other decks is possible through such stairway enclosures, self-closing "*A*" class fire doors are to be provided at each deck level. (See **Fig. R9.2.3-1**)

(2) In case where only stairways are provided in stairway enclosures and access to other decks is made through outside the enclosures at each deck level, the following **(a)** or **(b)** is to be complied with:

(a) In case of stairways with open steps, they are to be protected by self-closing "*A*" class fire doors at each deck level and at each end of each stair. (See **Fig. R9.2.3-2**)

(b) In case of stairways with closed steps in accordance with the provisions of Note to **Table R9.2, Part R of the Rules**, self-closing "*B*" class fire doors are to be provided at least at one end of each stair. (See **Fig. R9.2.3-3**)

14 With respect to the provisions of **9.2.3, Part R of the Rules**, the category of fan rooms serving machinery spaces of category *A* are to be as follows:

(1) A fan room solely serving machinery spaces of category *A* or multiple spaces containing machinery spaces of category *A*, may be treated as "other machinery spaces having little or no fire risk" referred to in footnote *i* of **Tables R9.1** and **R9.2**, **Part R of the Rules**. In this case:

(a) boundaries between the fan room and machinery spaces of category *A* are to be of "*A*-0" fire integrity;

(b) duct penetrations between fan rooms and machinery spaces of category *A* are to comply with **9.7.3-1(3), Part R of the Rules** regardless of the ventilation duct free cross-sectional area;

(c) ducts serving machinery spaces of category *A* are to be routed directly to the relevant fan(s) and from the fan to the louvers; and

(d) closing of the ventilation duct to/from machinery spaces of category *A* is to be possible from outside machinery spaces of category *A*. In this case, the controls for the closing of the machinery spaces of category *A* ventilation duct (i.e., a fire damper installed in accordance with **(b)** above) can be located inside the fan room.

(2) A fan room solely serving machinery spaces of category *A* may be considered as part of the machinery spaces of category *A*. In this case:

(a) requirements for fire integrity of the horizontal boundary between fan room and machinery spaces of category *A* need not apply; and

(b) closing the ventilation duct to/from machinery spaces of category *A* is to be possible from outside machinery spaces of category *A*. In this case, the controls for closing of the ventilation trunk are to be located outside the fan room and the machinery space of category *A*.

15 With respect to **Tables R9.1** and **R9.2, Part R of the Rules**, bulkheads and decks separating open decks (category **(10)**) and ro-ro/vehicle spaces (category **(11)**) are to be insulated in accordance with the following requirements:

(1) "*A*-0" fire integrity does not apply to hatches fitted on open decks adjacent to ro-ro/vehicle spaces, provided that such hatches are constructed of steel;

(2) "*A*-0" fire integrity does not apply to access doors to ro-ro/vehicle spaces fitted on open decks, provided that such access doors are constructed of steel; and

(3) "*A*-0" fire integrity does not apply to ventilators constructed of steel fitted on open decks adjacent to ro-ro/vehicle spaces.

16 With respect to **Tables R9.1** and **R9.2, Part R of the Rules**, bulkheads and decks separating ro-ro/vehicle spaces are to be insulated in accordance with the following requirements:

(1) Decks and bulkheads to be insulated to "*A*-30" fire integrity are those boundaries of single spaces protected by their own fire-extinguishing system;

(2) "*A*-30" fire integrity does not apply to hatches fitted on decks separating ro-ro/vehicle spaces, provided that such hatches are constructed of steel;

(3) Movable ramps installed on decks referred to in **(1)** above which form boundaries of "*A*-30" fire integrity are to be constructed of steel and are to be insulated to "*A*-30" fire integrity, except for "working parts" of such movable ramps (e.g. hydraulic cylinders, associated pipes/accessories) and members supporting such fittings which do not contribute to the structural strength of the boundary. Such movable ramps need not be subject to fire test. This is applicable to non-watertight doors used for loading/unloading of vehicles; and

(4) Where ducts for a ro-ro/vehicle spaces pass through other ro-ro/vehicle spaces without serving those spaces, each duct is to be insulated all along itself to "*A*-30" fire integrity in ways of other ro-ro/vehicle spaces unless the sleeves and fire dampers in compliance with **9.7.3-1, Part R of the Rules** in order to prevent spread of fire through the ducts are fitted (See **Fig. R9.2.3-16**).

17 With respect to the requirements of **9.2.3-2, Part R of the Rules**, a navigation locker that can only be accessed from the wheelhouse is to be considered as a control station, and Note e of **Table R9.1, Part R of the Rules** may be applied.

Fig. R9.2.3-16

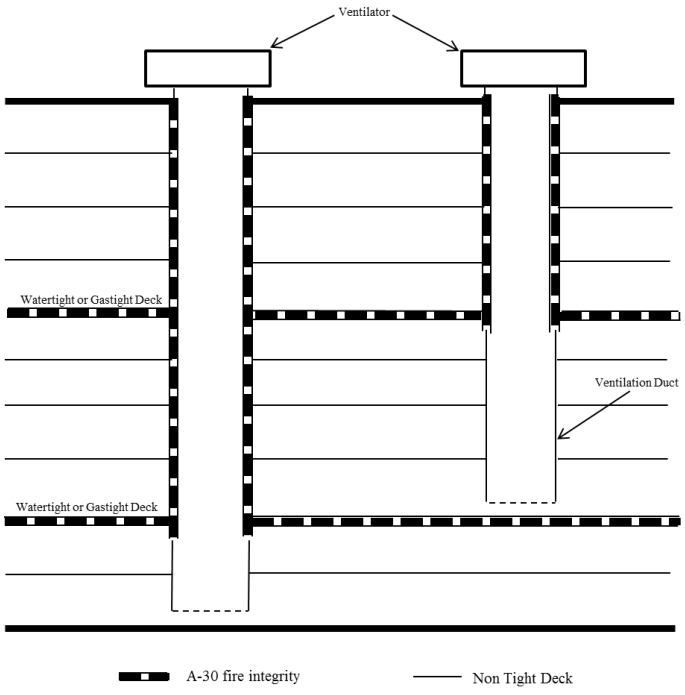


Table R9.2.3-1

Control stations	Spaces containing navigational apparatus (steering stand, compass and radar equipment) Electric rooms (where charging/discharging panels or battery charges are located), battery rooms, motor-generator rooms for navigational apparatus, radio or inverter rooms Spaces containing control systems and storage rooms of fire-extinguishing medium for fixed fire extinguishing systems (See Note **(1)** below) Navigation lockers that can only be accessed from the wheelhouse
Accommodation spaces	Telephone rooms (Telephone booths)
Service spaces with low risk of fire	Shore connection box rooms Electric rooms (where transformers, switchboards (see Note **(2)** below), motor-generators, etc. of less than 50 *kVA* (*kW*) are located and having area s of less than 4 m^2) Space where distribution panels and starters are located Accommodation ladder winch machinery rooms Ballast control rooms, main cargo control rooms
Other machinery spaces	Electric rooms (except those categorized as "control stations" or "service spaces with low risk of fire") Storage rooms for hydraulic units for deck machinery and cargo gears Propulsion motor rooms, Propulsion motor control rooms Steering gear rooms (See Note **(3)** below) Emergency fire pump rooms (See Note **(4)** below) Spaces containing deck foam systems (See Note **(5)** below) Spaces other than machinery spaces of category *A* where fuel oil piping lines are located Inert gas fan rooms Spaces where urea or sodium hydroxide solution tanks for selective catalytic reduction systems, exhaust gas recirculation systems or exhaust gas cleaning systems are installed (except in cases where such tanks are installed in machinery spaces of category *A*)
Service spaces with high risk of fire	Storage rooms for gaseous fuel (See Note **(6)** below) Storage rooms for gas welding equipments (See Note **(7)** below) Jumper lockers Mail rooms, specie rooms and workshops Provision store rooms (See Note **(8)** below) Refrigerating chambers (See Note **(9)** below)
Other spaces	1. To duct spaces and cable trunks, the requirements of **9.2.3-6, Part R of the Rules** for lift trunks are to apply. 2. Under deck passages of container ships with self-closing gas-tight doors separating the spaces from cargo spaces effectively, are to be regarded as void spaces. However, in case where they serve as escape route, they are to be regarded as corridors.

Notes:

(1) Except where permitted to be stored in the space protected by that fixed fire-extinguishing system according to the type of the system.

(2) Small distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, provided no provision is made for storage. Such location need not to be considered as a separate space nor categorized as a service space with low risk of fire.

(3) In case where an emergency fire pump is installed in the steering gear room or spaces which are only accessible directly therefrom (except from the engine room specified in **R10.2.2-4**), the fire integrity of boundaries between the space where the main fire pump is installed and the steering gear room is to be in accordance with **R10.2.2-3**.

(4) The fire integrity of boundaries separating from the space where the main fire pump is installed is to be in accordance with **10.2.2-3(2), Part R of the Rules**.

(5) Attention is paid to the provisions of **R4.5.2-3** and **-4**.

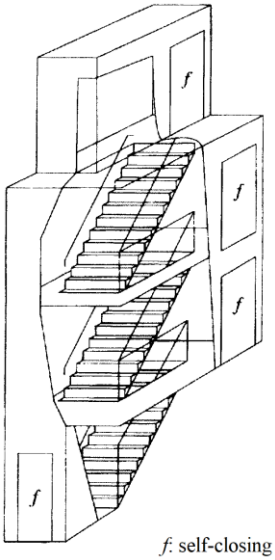
(6) The provisions of **4.3.1, Part R of the Rules** are to apply. In case where a portion of open deck, recessed into deck structure, machinery casing, deck house, etc., utilized for the exclusive storage of gas bottles in accordance with the provisions of **R4.3.1-3**, such a location may be regarded as open decks.

(7) The provisions of **4.3.2, Part R of the Rules** are to apply. In case where a portion of open deck, recessed into deck structure, machinery casing, deck house, etc., utilized for the exclusive storage of gas bottles in accordance with the provisions of **R4.3.2-4** or **-7**, such a location may be regarded as open decks.

(8) Such spaces having areas of less than 4 m^2 may be considered as a service space with low risk of fire.

(9) If thermally insulated with non-combustible materials, such spaces may be considered as a service space with low risk of fire.

Fig. R9.2.3-1

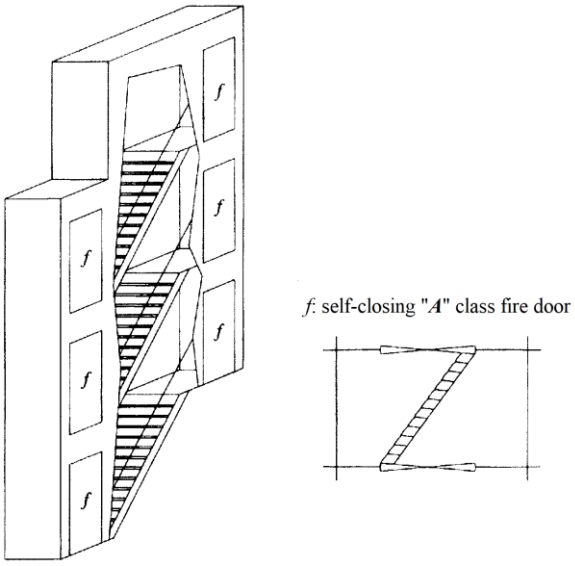


f: self-closing "***A***" class fire door

Note :

Stairways accessible to other decks not going out of the stairway enclosures.

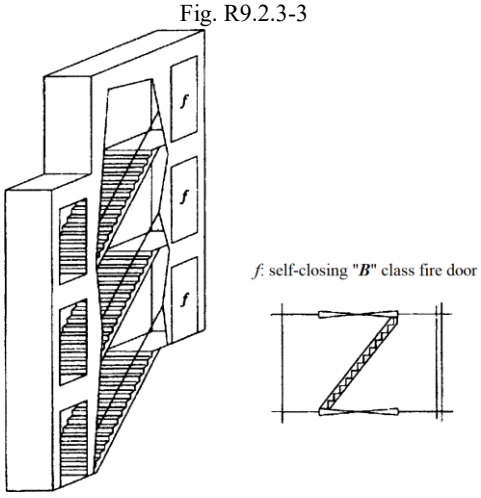
Fig. R9.2.3-2



Note :

Stairways with open steps. Only stairways are surrounded by an enclosure and access to other decks is made through outside the enclosure at each deck level and each end of stair.

Fig. R9.2.3-3



Note :

Stairways with fully closed steel stairs. Only stairways are surrounded by an enclosure and access to other decks is made through outside the enclosure at one end of each stair.

R9.2.4 Tankers

1 With respect to the requirements of **9.2.4-2, Part R of the Rules**, the provisions of **R9.2.3-1** to **R9.2.3-15** are to be referred to.

2 With respect to the requirements specified in **Table R9.3, Part R of the Rules**, "*A*" class bulkheads approved under the condition that the insulated side of such bulkheads are to be exposed spaces identified as fire hazards, may be used only for the following bulkheads **(1)** to **(2)**. In such cases, insulation shall be fitted on the fire hazard side. However, such "*A*" class bulkheads may be used for bulkheads other than those given in **(1)** to **(2)** in cases where deemed appropriate by the Society.

(1) "*A*-60" class bulkheads

(a) Accommodation spaces [Fire hazard side] and Control stations

(b) Machinery spaces of category *A* [Fire hazard side] and Control stations

(c) Machinery spaces of category *A* [Fire hazard side] and Corridors

(d) Machinery spaces of category *A* [Fire hazard side] and Stairways

(e) Machinery spaces of category *A* [Fire hazard side] and Service spaces (low risk)

(f) Service spaces (high risk) [Fire hazard side] and Control stations

(2) "*A*-15" class bulkheads

(a) Service spaces (low risk) [Fire hazard side] and Control stations

(b) Other machinery spaces [Fire hazard side] and Control stations

3 With respect to the requirements specified in **9.2.4-3, Part R of the Rules**, thermal insulation of superstructures and deckhouses facing the cargo oil tanks are to be in accordance with the following requirements **(1)** to **(6)**:

(1) The wording "whole of the portions facing cargo oil tanks and for 3 *m* aft of the front bulkhead" means the areas for 3 *m* as measured from the forward end of side walls of superstructures or deckhouses (See **Fig. R9.2.4-1**)

(2) In the case of the arrangement as shown in **Fig. R9.2.4-2**, "*A*-60" class insulation is to be applied to the aft end bulkhead of deck store rooms and side walls of accommodation spaces and service spaces of 3 *m* from the fore end thereof where they form the external boundaries of accommodation spaces and service spaces.

(3) "*A*-60" class insulation is to be in accordance with the requirements specified in **R9.7.2** of this Guidance.

(4) Insulation for the front bulkhead is to be carried up to the underside of the deck of the navigation bridge.

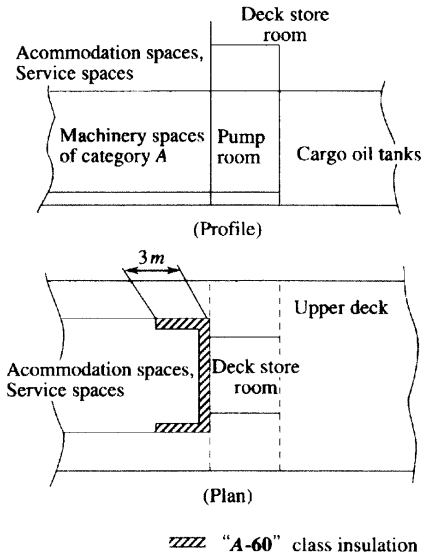
(5) The side walls of a wheelhouse having a structural arrangement unlikely to be exposed to flames in case of fire in way of cargo area (*e.g.*, the structural arrangement of a wheelhouse provided on the sponson deck) may not be provided with the insulation.

(6) Penetrations of pipes, cable, etc. made at the exterior boundaries being required to be insulated to "*A*-60" class standard, are to comply with the provisions of **9.3.1, Part R of the Rules**.

4 With respect to the requirements of **9.2.4-2, Part R of the Rules**, a navigation locker that can only be accessed from the wheelhouse is to be considered as a control station, and Note c of **Table R9.3, Part R of the Rules** may be applied.

Fig. R9.2.4-1

Fig. R9.2.4-2



R9.3 Penetration in Fire-resisting Divisions and Prevention of Heat Transmission

R9.3.1 Penetration in "*A*" Class Divisions

1 The detailed structural arrangements at the penetration parts of "*A*" class divisions specified in **9.3.1, Part R of the Rules** other than those required to be tested in accordance with the Fire Test Procedures Code by the provisions of **9.3.1** or **9.7.3-1, Part R of the Rules**, are to be in accordance with the **Annex R9.3.1 "DETAILS OF PENETRATIONS"**.

2 For the purpose of the requirements, "*A*" class divisions specified in **9.3.1, Part R of the Rules** includes a portion of exterior boundaries of superstructures and deckhouses being required to be insulated to "*A*-60" class standard.

R9.3.2 Penetration in "*B*" Class Divisions

With respect to the provisions of **9.3.2, Part R of the Rules**, arrangements ensuring that the fire resistance is not impaired mean that the structural arrangements at the penetration parts of "*B*" class divisions are in accordance with the requirements of **9.3.2** or **9.7.3-2, Part R of the Rules**, and the details are to be in accordance with the **Annex R9.3.1 "DETAILS OF PENETRATIONS"**. However, the structural arrangements at the penetrations tested in accordance with the Fire Test Procedures Code and approved by the Society or organizations deemed as appropriate by the Society need not comply with the above requirements.

R9.3.4 Prevention of Heat Transmission

"Treatment of terminal points and intersections of insulated bulkheads and decks" specified in **9.3.4, Part R of the Rules** is to be in accordance with the following requirements **(1)** to **(4)**:

(1) Insulation of stiffeners and girders, in case where their depth is 450 *mm* or less, is to be applied to the whole structure including the flanges or faceplates. Where the depth exceeds 450 *mm*, such insulation is to be applied to at least 450 *mm* in depth from bulkheads or decks (See **Fig. R9.3.4-1**). However, in case where the fire integrity has been verified by a standard fire test, this requirement may be dispensed with.

(2) The structural extension of insulation at intersections between uninsulated bulkheads, decks or knees is to be 450 *mm* or more. (See **Fig. R9.3.4-2**)

(3) In case where the lower part of insulation has to be cut for drainage, the construction is to be in accordance with the structural details in **Fig. R9.3.4-3**.

(4) The detailed insulation at the penetration parts of "*A*" and "*B*" class divisions are to be in accordance with the **Annex R9.3.1 "DETAILS OF PENETRATIONS"**.

Fig. R9.3.4-1

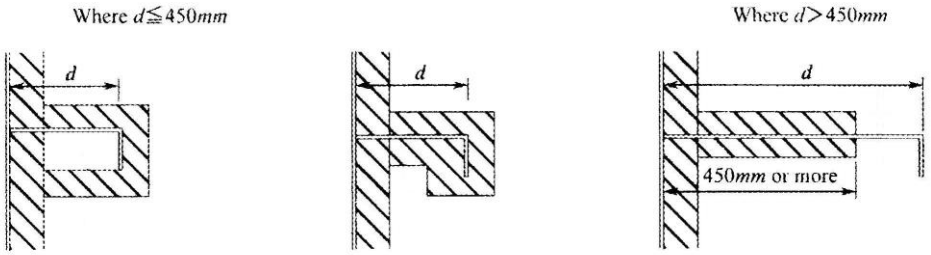


Fig. R9.3.4-2

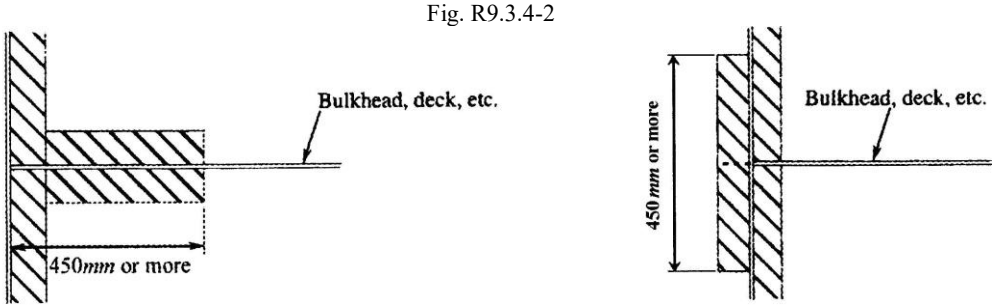
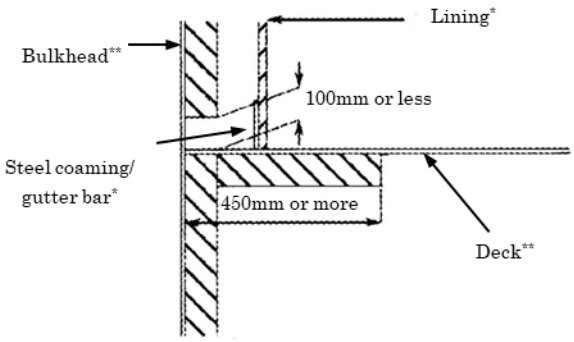


Fig. R9.3.4-3



Notes:

*: Lining and steel coaming/gutter bar are for accommodation spaces only.

: For the purpose of **Fig. R9.3.4-3, bulkhead and deck are of steel construction only.

R9.4 Protection of Openings in Fire Resisting Divisions

R9.4.1 Doors in Fire-resisting Divisions

1 The requirements for "*A*-0" class integrity of the outer boundaries of ro-ro spaces and vehicle spaces in **9.4.1, Part R of the Rules** need not apply to exterior doors except for those specified in the following **(1)** or **(2)**.

(1) Doors in superstructures and deckhouses facing lifesaving appliances, embarkation and muster station areas

(2) Doors in superstructures and deckhouses facing external stairs and open decks used for escape routes

2 With respect to the requirements of **9.4.1, Part R of the Rules**, for weathertight doors which are required by the provisions of **2.2.1.1-5, -6** or **2.2.1.5(2), Part 1, Part C of the Rules** and are independently arranged away from a group of accommodation spaces, the fire integrity of them may be in accordance with **9.4.4, Part R of the Rules**.

3 With respect to the requirements of **9.4.1, Part R of the Rules**, access hatches to under deck spaces (for example, cargo spaces) from deckhouses, boatswain's stores, etc. which are independently arranged away from a group of accommodation spaces may be weathertight. Access hatches to the under deck spaces from "other machinery spaces having little fire risk (See **R9.2.3-9**)" which are independently arranged away from a group of accommodation spaces, may also be weathertight.

R9.4.2 Doors of Self-closing Type

The wording "remote release devices of the fail-safe type" specified in **9.4.2, Part R of the Rules** means the device of which mechanism comes into action by applying a hook which is capable of being released by remote operation, and being automatically released even in case of failure of the system.

R9.4.3 Ventilation Openings

1 Exhaust from accommodation spaces, service spaces and control stations is to be evacuated through the exhaust ventilation ducts complying with the requirements of **9.7, Part R of the Rules**, except where ventilation openings are accepted under **9.4.3, Part R of the Rules**.

2 Where duct trunks for accommodation spaces, service spaces and control stations are provided adjoining to corridor bulkheads, notwithstanding the provisions of **9.4.3, Part R of the Rules**, ventilation openings with manual closing appliances operable from the corridor may be provided. In this case, grilles made of non-combustible materials are to be fitted to the ventilation openings. Furthermore, in case where the sectional area of such a ventilation opening exceeds 0.075 m^2, a self-closing type fire damper is to be provided in addition to the manual closing appliances.

3 With respect to the provisions of **9.4.3, Part R of the Rules**, ventilation openings of air inlets for air conditioning systems may be provided in corridor bulkheads in way of the air conditioning machinery rooms, subject to the following **(1)** to **(3)**.

(1) An automatic fire damper is to be provided.

(2) An air inlet from the corridor is to be led to the air conditioning machinery directly without any opening which allows air flow to the air conditioning machinery room.

(3) The ventilation opening is to be fitted with a grille made of non-combustible material.

R9.4.4 Fire Integrity for Watertight Doors

1 The term of "doors are to be designed and made to keep reasonable fire integrity" specified in **9.4.4, Part R of the Rules**, means watertight doors complying with the following requirements:

(1) Doors are to be made of steel;

(2) Packing for doors, if applicable, is to be of non-combustible material, except where other means are taken for ensuring gas-tightness deemed as reasonable by the Society when a fire, such packing may be of fire retardant material; and

(3) Doors other than those of sliding type are to be insulated, if applicable, as practicable.

2 Notwithstanding the provisions of **-1(2)** above, for watertight doors which are independently arranged away from a group of accommodation spaces, packing for such doors need not be of non-combustible materials subject that spaces on both side of such doors are classified in the categories of "service spaces (low risk)" or "other machinery spaces having little fire risk (See **R9.2.3-9**)".

3 If it is not practicable to ensure self-closing, means of indication on the bridge showing whether these doors are open or closed and a notice stating "To be kept closed at sea" can be used as an alternative to self-closing.

R9.5 Protection of Openings in Machinery Spaces Boundaries

R9.5.2 Protection of Openings in Machinery Space Boundaries

1 The means of control required in **9.5.2-3, Part R of the Rules** may be provided in corridors.

2 The wording "when access to any machinery space of category *A* is provided at a low level" specified in **9.5.2-5, Part R of the Rules** means a case where the lower end of the access opening is within 2.5 *m* from the bottom part of machinery spaces category *A*. The wording "light steel fire-screen door" specified in **9.5.2-5, Part R of the Rules** means a steel door provided with sufficient thermal insulation effective for shielding fire (equivalent to "*B*-0" class fire door), which is so light as to be operated by a single hand. This door is to be so installed as to have a space to permit passage of one person on the shaft tunnel side.

R9.7 Ventilation Systems

R9.7.1 General

1 The term "free cross-sectional area" specified in **9.7.1-1, Part R of the Rules** means, even if the case of a pre-insulated duct, the area calculated on the basis of the inner dimension of the duct except the insulation.

2 With respect to the "calorific value" specified in **9.7.1-1(1), Part R of the Rules**, reference is made to **R5.3.2**.

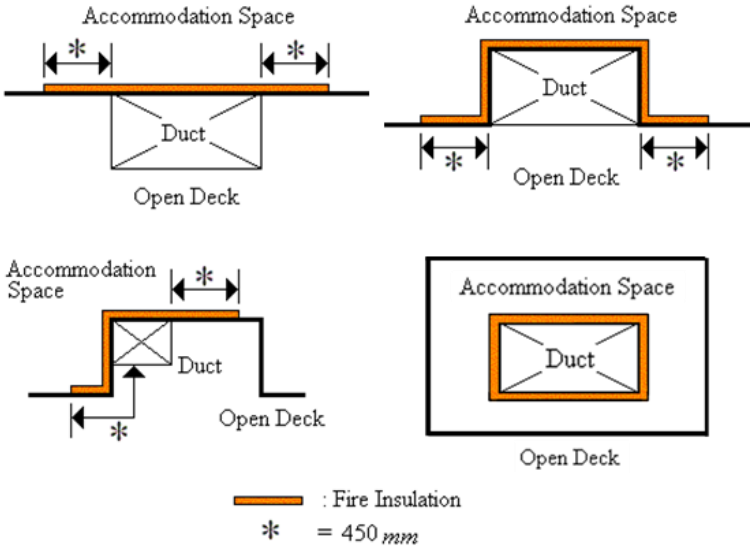
3 With respect to the provisions of **9.7.1-1, Part R of the Rules**, unless otherwise specified, a ventilation duct made of material other than steel may be considered equivalent to a ventilation duct made of steel, provided the material is non-combustible and has passed a standard fire test in accordance with Part 3 of Annex 1 to the *FTP* Code as non-load bearing structure for 30 *minutes* following the requirements for testing "*B*" class divisions.

R9.7.2 Arrangement of Ducts

1 Insulation of "*A*-60" class standard specified in **9.7.2-4, Part R of the Rules** is, as a standard, to be an insulation with rock-wool approved as non-combustible material, or insulation approved as "*A*-60" class.

2 With respect to the application of **9.7.2-5, Part R of the Rules**, a standard arrangement of the insulation of a duct is shown in **Fig. R9.7.2**.

Fig. R9.7.2 Examples for Insulation of Ducts



R9.7.3 Details of Fire Dampers and Duct Penetrations

1 With respect to the requirements of **9.7, Part R of the Rules**, in case where ducts penetrate either "*A*" class or "*B*" class divisions, the requirements specified in **R9.3** of this Guidance are to be complied with.

2 With respect to the provisions of **9.7.3, Part R of the Rules**, when the equipment for operating automatic fire dampers penetrates the divisions, such penetrations are to be properly constructed as required by **9.3.1, Part R of the Rules**. Where it is impracticable to

comply with the above provisions, automatic fire dampers are to be provided at each side of the divisions.

3 Ventilation inlets and outlets located at outside boundaries which are fitted with closing appliances as required by **5.2.1-1, Part R of the Rules**, need not comply with the requirements of **9.7.3, Part R of the Rules**.

4 Ducts with free sectional area of 0.075 m^2 or less need to be fitted with fire damper at their passage through Class "*A*" divisions in those cases indicated in requirements **9.7.2-2 Part R of the Rules** and **9.7.2-3 Part R of the Rules**. The fire damper can be omitted if the duct is arranged in compliance with the requirements of **9.7.2-4(2) Part R of the Rules**.

5 With respect to the provisions of **9.7.3-1(3), Part R of the Rules**, it is recommended that the insulation for duct between the damper and the penetrated bulkheads or deck be at least of the same fire integrity as the division through which the duct passes.

R9.7.4 Exhaust Ducts from Galley Ranges

1 With respect to the requirements in **9.7.4, Part R of the Rules**, the exhaust ducts from galley ranges are to be in accordance with the following requirements **(1)** to **(3)**:

(1) The exhaust ducts from galley ranges are, in principle, to be independent from other ducts. In case where this is impracticable, i.e., where the ducts are connected to other ducts for other ventilation purposes, self-closing type fire dampers which can be remotely-operated are to be fitted to the other branch ducts in order to be capable of closing these dampers together with those for galley ranges simultaneously.

(2) Unless otherwise permitted by the Society, the term of "spaces containing combustible materials" will normally apply to all spaces in accommodation.

(3) With respect to the requirements in **9.7.4(4), Part R of the Rules**, fixed means for extinguishing a fire is to be in accordance with either of the following:

(a) *ISO* 15371: 2009 "*Ships and marine technology – Fire-extinguishing systems for protection of galley cooking equipment*",

(b) **10.6.2-1(1), Part R of the Rules**, or

(c) other standards accepted by the Administration

2 With respect to the application of **9.7.4, Part R of the Rules**, when a part of an exhaust duct for galley range is contiguous to accommodation spaces or other spaces containing combustible materials, at outside the galley, such ducts are to be in accordance with the provisions of **R9.7.2-2**.

R10 FIRE FIGHTING

R10.1 General

R10.1.1 Purpose

With respect to the wording "open-top container holds" specified in **10.1.1-2, Part R of the Rules**, reference is made to the "*Interim Guidelines for Open-top Containerships*" (*MSC/Circ.*608/*Rev.*1).

R10.2 Water Supply Systems

R10.2.1 Fire Mains and Hydrants

1 The wording "arrangement of pipes and hydrants to avoid the possibility of freezing" specified in **10.2.1-1, Part R of the Rules** means those as follows:

(1) Pipes and fire hydrants at exposed parts are to be provided with suitable insulation.

(2) Scupper valves, etc. are to be provided for draining water for the pipes at exposed parts with piping laid in such a way that no water accumulate in the piping as far as practicable.

2 With respect to the requirements of **10.2.1-2, Part R of the Rules**, where the main fire pumps are remotely started, sea suction and outlet valves of such pumps in the machinery space are to be capable of being opened from the same location where the pumps are started. Otherwise such valves are to be of locked open type and an adequate information such as "Keep open" on a notice board is to be attached thereto.

3 With respect to the provisions of **10.2.1-4(1), Part R of the Rules**, any part of the fire main isolated by the isolating valves from the section of the fire main within the machinery space containing the main fire pump or pumps is to be routed outside such machinery space, except for short lengths of suction or discharge piping for emergency fire pumps complying with **10.2.1-4(1), Part R of the Rules**. Such isolating valve is provided is to be a corridor within the accommodation space or the fire control station. In case where the valve is provided on open deck or other spaces, the position of the installation is to be such that the valve will be free from damage by cargo loaded on deck or free from mechanical damage, and that operation of the valve would not be impaired by such cargo loaded on deck or storage goods. In case where the valve is provided on open deck, means are to be provided to prevent the valve from freezing. When the valve is provided in a corridor, such corridor need not be dealt with the control station.

4 With respect to the provisions of **10.2.1-4(1), Part R of the Rules**, where the sea-chest is fitted in the machinery space, the sea-chest valve is not to be a fail-close type in cases where the remotely controlled system of the valve can be disabled by fire. Devices, pipings and cables, etc. for the operation of the sea-chest valve are to be enclosed in a substantial steel casing or are to be insulated to "*A*-60" class standards. In addition, such cables are to be in accordance with the provisions of **2.9.11-2, Part H of the Rules**. However, devices, pipings and cables, etc. for the operation of the sea-chest valve are not necessary to be enclosed in a substantial steel casing or to be insulated to "*A*-60" class standards provided that the sea-chest valve is a fail-open type even in cases where the remotely controlled system of the valve can be disabled by fire.

5 With respect to the provisions of **10.2.1-4(1), Part R of the Rules**, in cases where suction or discharge piping penetrates machinery spaces, it is not necessary for "distance pieces", "sea inlet valves" and "sea-chests" to be enclosed in a substantial steel casing or to be insulated to "*A*-60" class standards. The method for insulating pipes to "*A*-60" class standards is that they are to be covered or protected in a practical manner by insulation material which is approved as a part of "*A*-60" class divisions in accordance with the *FTP Code* and is approved by the Society or organizations deemed appropriate by the Society.

6 With respect to the provisions of **10.2.1-4(1), Part R of the Rules**, in cases where main fire pumps are installed in compartments outside machinery spaces and where the emergency fire pump suction or discharge piping penetrates such compartments, the provisions of **-4** and **-5** above are to apply.

7 The wording "isolation valves are to be fitted in the fire main at poop front in a protected position" specified in **10.2.1-4(4), Part R of the Rules** means that the valve is to be located within an accommodation space, service space or control station. However, the valve may be located on the open deck aft of the cargo area provided that the valve is located:

(1) at least 5 *m* aft of the aft end of the aftermost cargo tank; or

(2) if the above **(1)** is not practical, within 5 *m* aft of the aft end of the aftermost cargo tank provided the valve is protected by a permanent steel obstruction.

8 With respect to the requirements of **10.2.1-3, Part R of the Rules**, the diameter of the fire main in ships designed to carry five or more tiers of containers on or above the weather deck is to be in accordance with **R10.2.2-9** and **-10**.

R10.2.2 Fire Pumps

1 With respect to the requirements of **10.2.2-3(1), Part R of the Rules**, where the main fire pumps are arranged in accordance with the following requirements, a fixed emergency fire pump is not required.

(1) Two main fire pumps, their sea suctions and the fuel supply or source of power for each pump are situated independently each other within compartments separated at least by "*A*-0" class divisions; and

(2) One main fire pump is located in a compartment not having more than one bulkhead or deck adjacent to the compartment containing the other main fire pump.

2 The fixed emergency fire pump specified in the requirements of **10.2.2-3, Part R of the Rules** is, in principle, not to be installed in area apart from those usually employed by the crew. Due to unavoidable reasons, if the fixed emergency fire pump is provided at the bow in ships having their accommodation space at the stern, or provided in the lower stool of cargo hold, the pump as well as the valves are to be operable by remote control from the navigation bridge or the fire control station in addition to the local manual control.

3 With respect to the provisions of **10.2.2-3(2), Part R of the Rules**, when a single access to the emergency fire pump room is through another space adjoining a machinery space of category *A* or the space containing the main fire pumps, boundaries between that other space and the machinery space of category *A* or the spaces containing the main fire pumps are to be insulated by "*A*-60" class standard.

4 With respect to the requirements of **10.2.2-3(3), Part R of the Rules**, the wording "machinery spaces" means the machinery spaces where the main fire pumps are installed. Where a direct access is provided between machinery spaces and a space where emergency fire pump is installed, **Fig. R10.2.2-1** and **Fig. R10.2.2-2** are to be referred to as the standard arrangements. In this case extension of thermal insulation is to be 450 *mm* or more. (See the mark "※" in **Fig. R10.2.2-1** and **Fig. R10.2.2-2**)

5 The provisions of **10.2.2-3(5), Part R of the Rules** do not force to choose pumps with capacity and pressure characteristics other than that being optimal for the service intended, just to make their connection to the fire main possible, provided the required number and capacity of fire pumps are already fitted.

6 With respect to the requirements of **10.2.2-3(6), Part R of the Rules**, at least one of the fire pump is to be connected to a sea chest which is provided with de-icing arrangements.

7 With respect to the requirements of **10.2.2-4, Part R of the Rules**, required pump capacity is to be capable of delivering two jets of water which are reachable not less than 12 *m* in distance. However, for the emergency fire pump required in **10.2.2-3(1), Part R of the Rules**, the above requirements may be applied to those delivered through nozzles of 12 *mm* diameter.

8 With respect to the requirements of **10.2.2-4(1), Part R of the Rules**, "*d*" specified in **13.5.4-2, Part D of the Rules** is a value obtained from the formula specified in **13.5.3-1(1), Part D of the Rules**.

9 With respect to the requirements of **10.2.2-4(1), Part R of the Rules**, for ships designed to carry five or more tiers of containers on or above the weather deck, in cases where the mobile water monitors specified in **10.7.3-2, Part R of the Rules** are supplied by separate pumps and piping system, the total capacity of the main fire pumps need not exceed 180 m^3/h and the diameter of the fire main and water service pipes (hereinafter referred to as "the pipework diameter") need only be sufficient for the discharge of 140 m^3/h.

10 With respect to the requirements of **10.2.2-4(1), Part R of the Rules**, for ships designed to carry five or more tiers of containers on or above the weather deck, in cases where the mobile water monitors specified in **10.7.3-2, Part R of the Rules** are supplied by the main fire pumps, the total capacity of required main fire pumps and the pipework diameter are to be sufficient for simultaneously supplying both the required number of fire hoses and mobile water monitors. However, the total capacity is not to be less than the following **(1)** or **(2)**, whichever is smaller:

(1) four thirds of the quantity required by **13.5.4-2, Part D 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; or

(2) 180 m^3/h.

R10.2.3 Fire Hoses and Nozzles

1 With regard to "the fire hoses of non-perishable materials approved by the Society" in **10.2.3-1(1), Part R of the Rules** and

the "approved dual purpose type incorporating a shut off" in **10.2.3-3(4), Part R of the Rules**, the wording "approved" means to have passed the inspection by organizations authorized by the Administration or deemed appropriate by the Society.

2 Aluminum alloys may be used for couplings and nozzles of fire hose specified in **10.2.3, Part R of the Rules**, except in open deck areas of the following ships **(1)** or **(2)**.

(1) Tankers carrying crude oil and petroleum products having a flash point not exceed 60℃.

(2) Chemical tankers other than those to which the requirements of either **11.1.2** or **11.1.3, Part S of the Rules** are applied.

3 With respect to the requirements of **10.2.3-3, Part R of the Rules**, the inside diameters of the tips of nozzles for injecting water to the machinery spaces or exposed areas are to be as given in **Table R10.2.3-1** as a standard.

Fig. R10.2.2-1

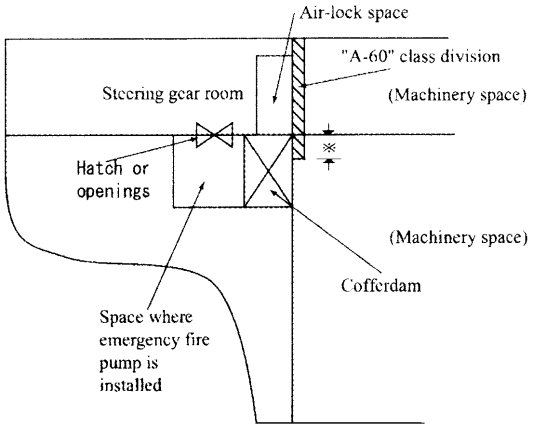
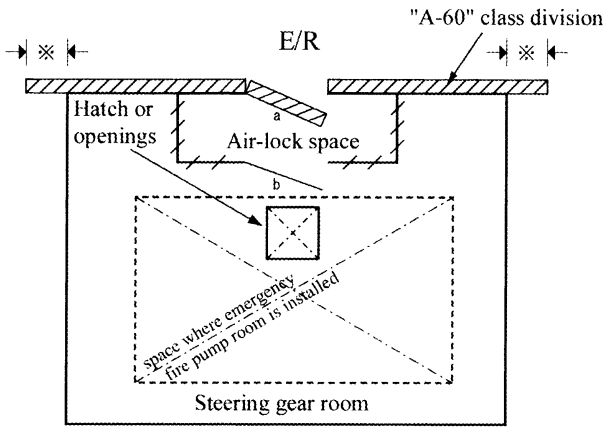


Fig. R10.2.2-2



: Bulkhead of steel or equivalent material
a : "A-60" class division
b : Reasonably gastight door of steel or other equivalent material
a and b : self-closing door without holdback hook

Table R10.2.3-1 Inside Diameter of Nozzle Tips

Value of $K\sqrt{Q}$	Inside dia. of nozzle (mm)
Less than 16	12
16 and over to 19 exclusive	16
19 and over to 22 exclusive	19
22 and over	19 or 22

Note

Q : Capacity of the smallest pump (m^3/hr)

K : Values specified in **Table R10.2.3-2**

Table R10.2.3-2 Values of K

Specified pressure at fire hydrant (MPa)	K
0.27	2.85
0.25	2.90

R10.3 Portable Fire Extinguishers

R10.3.2 Arrangement of Fire Extinguishers

1 Portable fire extinguishers for accommodation spaces, service spaces and control stations required in **10.3.2-1, Part R of the Rules** are to be, generally, arranged in accordance with **Table R10.3.2-1**.

2 In case where the central control station is arranged as shown in **Fig. R7.5.1-1**, at the entrance of the spaces which can be regarded as the service spaces (including the boundary between the space and a space which can be regarded as the navigation bridge), portable fire extinguishers are to be provided.

3 The wording "portable fire extinguishers which are to be as deemed appropriate by the Society" specified in the provisions of **10.3.2-5, Part R of the Rules,** refers to those extinguishers that correspond to the Class *B* ones specified in note (2) of **Table R10.3.2-1** and are of sufficient capacity.

Table R10.3.2-1 Minimum Numbers and Distribution of Portable Fire Extinguishers in the Various Types of Spaces Onboard Ships

Type of space[1]		Minimum number of extinguishers	Class(es) of extinguisher(s) [2]
Accommodation spaces	Public spaces[3]	1 per 250 m^2 of deck area or fraction thereof	*A*
	Corridors	Travel distance to extinguishers should not exceed 25 *m* within each deck	*A*
	Stairway	0	
	Lavatories, cabins, offices, pantries, containing no cooking appliances	0	
	Hospital	1	*A*
Service spaces	Laundry drying rooms, pantries containing cooking appliances	1[4]	*A* or *B*
	Lockers and store rooms (having a deck area of 4 m^2 or more), baggage rooms and workshops[3] (not part of machinery spaces, galleys)	1[4]	*B*
	Galleys	1 class *B* and 1 Additional class *F* or *K* for galleys with deep fat fryers	*B*, *F* or *K*
	Lockers and store rooms(deck area is less than 4 m^2)	0	
	Other spaces in which flammable liquids are stowed	In accordance with **10.6.2, Part R of the Rules**	
Control stations	Control stations (other than wheelhouse)	1[5]	*A* or *C*
	Wheelhouse	2, if the wheelhouse is less than 50 m^2 only 1 extinguisher is required	*A* or *C*

Notes:

(1) Unless otherwise specified, one of portable fire extinguishers required is to be located at or near entrance and exits in the space. If a space is locked when unmanned, portable fire extinguishers required for that space may be kept inside or outside the space.

(2) The types of portable fire extinguishers are classified below. However, with respect to the application of the requirements specified in **R24.1.2**, such classifications need not apply to extinguishers which have been deemed appropriate for use at certain locations in accordance with standards approved by the relevant Administration or organizations deemed appropriate by the Society.

Fire Classifications

International Organization for Standardization (ISO standard 3941)	National Fire Protection Association (NFPA 10)
Class *A*: Fire involving solid materials, usually of an organic nature, in which combustion normally takes places with the formation of glowing embers.	Class *A*: Fires in ordinary combustible materials such as wood, cloth, paper, rubber and many plastics.
Class *B*: Fires involving liquids or liquefiable solids	Class *B*: Fires in flammable liquids, oils, greases, tars, oil base paints, lacquers and flammable gases.
Class *C*: Fires involving gases.	Class *C*: Fires, which involve energized electrical equipment where the electrical non-conductivity of the extinguishing medium is of importance. (When electrical equipment is de-energized, extinguishers for class *A* or *B* fires may be used safely.)
Class *D*: Fires involving materials.	Class *D*: Fires in combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium.
Class *F*: Fires involving cooking oils.	Class *K*: Fires involving cooking grease, fats and oils.

(3) It is recommended that the portable fire extinguishers except **(1)** above in public spaces and workshop be located at or near the main entrances and exits.

(4) A portable fire extinguisher required for that small space placed outside or near the entrance to that space may also be considered as part of the requirement for the space in which it is located.

(5) If the wheelhouse is adjacent with the chartroom and has a door giving direct access to chartroom, no additional fire extinguisher is required in the chart room.

R10.3.3 Spare Charges

With respect to the requirements of **10.3.3, Part R of the Rules**, spare charges mean the spares for fire-extinguishing medium and those deemed as necessary for discharging the medium such as compressed air cylinders. Fire extinguishers counted out of the number required in **Part R of the Rules** may be considered as spare charges. The spare charges are to be enclosed in receptacles so that no solidification, moisture absorption, degeneration and/or other abnormality would be caused.

R10.4 Fixed Fire-extinguishing Systems

R10.4.1 General

With respect of the provisions of **10.4.1-5, Part R of the Rules**, when commonly served for fixed water-based fire-extinguishing systems (excepting those for cargo spaces), pump systems are to comply with the following **(1)** to **(5)**.

(1) Each fire-extinguishing system is to comply with the performance standards required for each system when the system operates independently.

(2) Failure of any one component in the power and control system is not to result in a reduction of the total pump capacity below that required by any of the areas the system is required to protect, e.g. pump units arranged as 2x100%, 3x50%, etc. with a dedicated starter cabinet or equivalent arrangements will be accepted. Back-up arrangements are not required for the remote release controls.

(3) Alarms for typical faults in the power and control system are to be provided in a continuously manned control station. Means

are to be provided to ensure that the system can be operated manually from positions outside the protected area(s) in case of such faults.

(4) The system is to be arranged to avoid a single failure (including pipe rupture) in one protected area resulting in the system being inoperable in another protected area.

(5) Redundant arrangements for power and water supply are to be located in different compartments separated by *A* class divisions.

R10.4.3 Storage Rooms of Fire-extinguishing Medium

1 The requirements specified in **(2)**, **(4)**, **(5)** and **(6)** of **10.4.3, Part R of the Rules** for storage rooms may be applied only to the storage rooms of fixed gas fire-extinguishing systems. For equivalent fixed gas fire-extinguishing systems specified in **25.2.4, Part R of the Rules**, the requirements of **10.4.3, Part R of the Rules** are to be applied to their storage rooms, unless specified otherwise according to the provisions of **R25.2.2-2**.

2 With respect to the requirements specified in **10.4.3(5), Part R of the Rules**, any space that only permits an access vertically through a hatch provided on an exposed deck is not deemed to be a space where access from the open deck is provided.

3 With respect to the requirements specified in **10.4.3, Part R of the Rules**, where fire-extinguish media protecting the cargo holds is stored in a room located forward the cargo holds, such arrangement is to be in accordance with the provisions of **R25.2.1-6**.

R10.5 Fire-extinguishing Arrangements in Machinery Spaces

R10.5.1 Machinery Spaces Containing Oil-fired Boilers or Oil Fuel Units

1 With respect to the requirements specified in **10.5.1, Part R of the Rules**, the requirements of fire-extinguishing systems required for machinery spaces containing oil-fired boilers, oil fuel units or internal combustion engines are to be as given in **Table R10.5.1-1**. However, for the use of this table, oil-fired machinery other than boilers such as fired inert gas generators, incinerators and waste disposal units are to be considered the same as oil-fired boilers.

2 With respect to the requirements specified in **10.5.1-2, Part R of the Rules**, in addition to **-1** above, portable fire extinguishers for machinery spaces of category *A* are, in general, to be arranged in accordance with **Table R10.5.1-2**.

3 In case where the rate of steam evaporation of a boilers converted into *kW*, the following formula may be applied:

$$F = 2.778 \times 10^{-4} G(i_1 - i_2)$$

F : output (*kW*)

G : actual rate of steam evaporation at designed pressure (*kg/hour*)

i_1 : specific enthalpy of dry saturated steam at designed pressure (*kJ/kg*)

i_2 : specific enthalpy of saturated water at feed water

4 The wording “approved foam fire extinguishers” and the wording “approved portable fire extinguishers” specified in **10.5.1, Part R of the Rules**, mean the fire extinguishers complying with the requirements **Chapter 24, Part R of the Rules**. Types of fire extinguishers not specified in these provisions are to be in accordance with the provisions of note (2) of **Table R10.3.2-1** with respect to their purpose of use on a case-by-case basis.

5 With respect to the requirements specified in **10.5.1-2(2), Part R of the Rules**, a carbon dioxide gas fire extinguisher with a mass of 45 *kg* may be deemed equivalent to a foam fire extinguisher with a capacity of 135 *litres* in fire extinguishing efficiency. A carbon dioxide fire extinguisher with a mass of 16 *kg* or a powder fire extinguisher with a mass of 23 *kg* may be deemed equivalent to a foam fire extinguisher with a capacity of 45 *litres* in fire-extinguishing efficiency. In case where the carbon dioxide gas fire extinguishers provided in ships which are capable of discharging the carbon dioxide gas to all areas within the spaces of boiler rooms, etc. and the quantity of the carbon dioxide gas used exclusively for such purpose is not less than 16 *kg*, such fire-extinguishing arrangement may be deemed equivalent to a foam fire extinguisher with a capacity of 45 *litres* in fire-extinguishing efficiency.

6 The wording “each space in which a part of the oil fuel installation is situated” specified in **10.5.1-2(2), Part R of the Rules** means the space in which fuel oil transfer pumps or oil purifiers are provided or the space where an aggregate of valves of the fuel oil transfer line are provided among the spaces provided with the oil fuel installations.

7 With respect to the requirements of **10.5.1-2(2), Part R of the Rules**, in the room for domestic boilers of less than 175 *kW*, at least one approved foam type extinguisher of at least 45 *litres* capacity is to be provided. However, when the boilers are protected by fixed water-based local application fire-extinguishing systems as required by **10.5.5, Part R of the Rules**, the requirements may not apply.

Table R10.5.1-1 Fire Extinguishers in Machinery Space and Boiler Room

Fire-extinguishing arrangements in machinery space of category *A*		Fixed fire extinguishing system	Portable foam applicator(1)	Portable foam extinguishers	Additional portable foam extinguishers	135 *l* foam extinguisher	45 *l* foam extinguishers(2)	Sand boxes(3)
Reference Part R of the Rules		**10.5.1-1(1) 10.5.2-1**	**10.5.1-2(1) 10.5.2-2(1)**	**10.5.1-2(2)**	**10.5.2-2(2)**	**10.5.1-2(2)**	**10.5.2-2(2)**	**10.5.1-2 (3)**
Boiler Room	Containing oil- fired boilers	1	1	2N	NA	1(4)	-	N
	Containing oil-fired boilers and oil fuel units	1	1	2N+2	NA	1(4)	-	N
Engine room	Containing oil fuel units only	1	-	2	NA	-	-	-
	Containing internal combustion machinery	1	1	x		-	y	-
	Containing internal combustion machinery and oil fuel units	1	1	x		-	y	-
	Containing internal combustion machinery, oil fired boilers and oil fuel units	1	1	(2N+2) or x whichever is greater		1(4)	y(5)	N

Notes:

N : Number of firing spaces. "2N" means that two extinguishers are to be located in each firing space.

x : Sufficient number, minimum two in each space, so located that no point in the space is more than 10 *m* walking distance from an extinguisher.

y : Sufficient number to enable foam to be directed onto any part of the fuel and lubricating oil pressure systems, gearing and other fire hazards.

(1) May be located outside of the entrance of boiler room.

(2) May be arranged outside of the space concerned where they are small spaces in cargo ships.

(3) A shovel for spreading dry materials is to be provided. Sand boxes may be substituted by approved portable fire extinguishers.

(4) In the case of domestic boilers of less than 175 *kW*, or boilers protected by fixed water-based local application fire-extinguishing systems as required by **10.5.5, Part R of the Rules**, 135 *litres* foam extinguisher need not be provided.

(5) In case of machinery spaces containing both boilers and internal combustion machinery, the requirements of **10.5.1** and **10.5.2, Part R of the Rules**, are to apply with the exception that the one of the foam fire extinguishers of at least 45 *litres*

capacity or equivalent may not be provided where it is recognized by the Society that the 135 *litres* extinguisher required by **10.5.1-2(2), Part R of the Rules** can protect efficiently and readily the area covered by the 45 *litres* extinguishers.

Table R10.5.1-2 Minimum Numbers and Distribution of Portable Fire Extinguishers in the Various Types of Spaces Onboard Ships

Type of space(1)	Minimum number of extinguishers	Class(es) of extinguisher(s) (2)
Central control station for propulsion machinery	1, and 1 additional extinguisher suitable for electrical fires when main switchboards are arranged in central control station	*A* and/or *C*
Vicinity of the main switchboards	2	*C*
Workshops(3)	1	*A* or *B*
Enclosed space with oil-fired inert gas generators, incinerators and waste disposal units	2	*B*
Separately enclosed room with fuel oil purifiers	0	
Periodically unattended Machinery spaces of category *A*	1 at each entrance(4)	*B*

Notes:

(1) Unless otherwise specified, one of portable fire extinguishers required is to be located at or near entrance and exits in the space. If a space is locked when unmanned, portable fire extinguishers required for that space may be kept inside or outside the space.

(2) The types of portable fire extinguishers are to be in accordance with notes (2) of **table R10.3.2-1**.

(3) It is recommended that the portable fire extinguishers except **(1)** above in workshop be located at or near the main entrances and exits.

(4) A portable fire extinguisher required for that small space placed outside or near the entrance to that space may also be considered as part of the requirement for the space in which it is located.

R10.5.2 Machinery Spaces of Category *A* Containing Internal Combustion Machinery

1 With respect to the requirements of **10.5.2, Part R of the Rules**, the provisions of **R10.5.1-1** to **R10.5.1-5** of this Guidance are to be applied.

2 For "each such space" specified in **10.5.2-2(2), Part R of the Rules**, spaces to which persons normally have no access may be excluded.

3 The wording "the fuel and lubricating oil pressure systems" specified in **10.5.2-2(2), Part R of the Rules** means, for example, valves, strainers, etc. of the internal combustion engines, fuel oil transfer pumps, oil burning pumps, lubricating oil coolers, oil purifiers, reversing gears, reduction gears and hydraulic piping.

R10.5.3 Machinery Spaces Containing Steam Turbines or Enclosed Steam Engines

1 With respect to the requirements of **10.5.3, Part R of the Rules**, the provisions of **R10.5.1-1** to **R10.5.1-5** and **R10.5.2-2** of this Guidance are to be applied.

2 The wording "total output" specified in **10.5.3-1, Part R of the Rules** means the total aggregate of the maximum continuous power output of each engine.

R10.5.4 Other Machinery Spaces

1 In the following spaces, where are deemed as spaces "where a fire hazard exists" specified in **10.5.4, Part R of the Rules** by the Society, at least one approved portable fire extinguisher is to be provided. And, the type of portable fire extinguisher has to correspond to the Class *B* or *C* ones specified in note (2) of **Table R10.3.2-1**.

(1) Spaces containing forced lubricating oil systems or hydraulic oil systems, fuel oil stations and other spaces where a oil-fire

hazard may exist (except the spaces specified in **(2)** below).

(2) Spaces containing refrigerating machinery, ventilation machinery (except those of small capacity and dedicated for a single duct), air conditioning machinery or other spaces where an electrical fire hazard may exist.

(3) Workshops forming part of machinery spaces

2 For the fire extinguishers specified in **-1** above, the provisions of **R10.5.1-4** of this Guidance is to be applied.

3 With respect to the requirements of **-1** above, **Part R of the Rules**, the portable fire extinguishers required is to be located at or near entrance and exits in the space. If a space is locked when unmanned, portable fire extinguishers required for that space may be kept inside or outside the space.

R10.5.5 Fixed Local Application Fire-fighting Systems

1 The wording "approved type of fixed water-based or equivalent local application fire-fighting system" (hereinafter referred to as "the fire-fighting system" in this **R10.5.5**) specified in **10.5.5-2, Part R of the Rules** means the system approved by organizations authorized by the Administration or deemed appropriate by the Society in accordance with *MSC.*1/*Circ.*1387 "*Revised Guidelines for the approval of fixed water-based local application fire-extinguishing systems for use in category A machinery spaces* (*MSC/Circ.*913)".

2 Nozzle installations are to be determined as in the following **(1)** or **(2)** corresponding to the test results in accordance with *MSC.*1/*Circ.*1387 as specified in **-1** above. When the nozzles are installed in the different manner from the conditions determined by the test, additional fire tests deemed as necessary by the Society are to be carried out to verify the fire-extinguishing capabilities.

(1) For nozzles of a system that extinguishes fires referred to in 3.3.2.1 to 3.3.2.3 of Appendix of Annex to *MSC.*1/*Circ.*1387

(a) Nozzles installed in grid: See **Fig. R10.5.5-1**

(b) Nozzles installed in a single row: See **Fig. R10.5.5-2**

(c) Single nozzle: See **Fig. R10.5.5-3**

(2) For nozzles of a system that extinguishes fires referred to in 3.3.2.3 to 3.3.2.5 of Appendix of Annex to *MSC.*1/*Circ.*1387

(a) Nozzles installed in grid: See **Fig. R10.5.5-4**

(b) Nozzles installed in a single row: See **Fig. R10.5.5-5**

(c) Single nozzle: See **Fig. R10.5.5-3**

3 With respect to the provisions of **10.5.5-3, Part R of the Rules**, the fire-fighting system is to be provided so as to being capable of activating for each area protected by the fire-fighting system (hereinafter, referred to as "the protected area" in this **R10.5.5**). Where two or more devices are provided for the same purpose such as machinery used for the ship's main power generation, in general, such devices are to be grouped to two or more so as to being capable of activating the fire-fighting system for each group. (Preferably, the fire-fighting system should be provided so as to being capable of activating for each device.)

4 The operation controls for manual release required in **10.5.5-2, Part R of the Rules** are to be located at easily accessible positions inside and outside the machinery space of category *A* (hereinafter referred to as "the protected space" in this **R10.5.5**). For the controls inside the space, the provisions of **R4.2.2-16** are to be referred to. At the every control positions, instructions for the operation of the fire-fighting system are to be posted.

5 The system of automatic release required in **10.5.5-2, Part R of the Rules** is to be provided with an override device for manual operation.

6 The systems of automatic release required in **10.5.5-2, Part R of the Rules** are to be designed to detect and identify a local fire quickly and accurately to prevent unexpected activation, this being, in general, achieved by any of the fire detection system specified in **(1)** through **(3)**.

In this case, the fire detection system is to follow the requirements for those provided in the protected space under the provisions of **7.4, Part R of the Rules**. The automatic release will be achieved so that a flame type fire detector provided for each area protected by the fire-fighting system detects a local fire and activates fire alarm, after then, if any detector provided in the machinery spaces of category *A* detects the fire, the fire-fighting system comes into action with an activation alarm specified in **10.5.5-4, Part R of the Rules**.

(1) Two flame type fire detectors complying with the requirements of **Chapter 29, Part R of the Rules**, which may be used as a part of the fire detecting and alarm systems for machinery spaces of category *A* required in **7.4, Part R of the Rules**.

(2) One flame type fire detector and one smoke type fire detector complying with the requirements of **Chapter 29, Part R of the Rules**, which may be used as a part of the fire detecting and alarm systems for machinery spaces of category *A* required in **7.4, Part R of the Rules**.

(3) Other arrangements deemed appropriate by the Society. However, the use of heat type fire detectors is, in principle, not acceptable for these systems.

Fig. R10.5.5-1

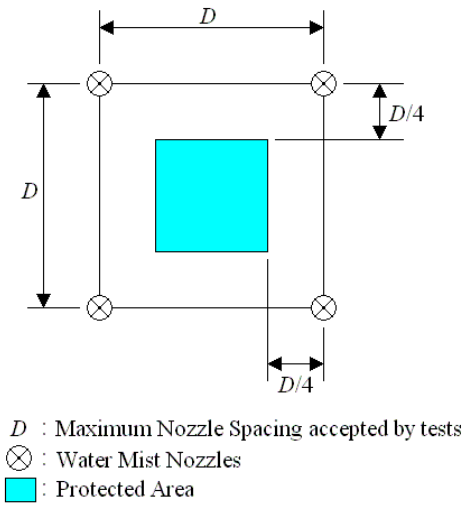


Fig. R10.5.5-2

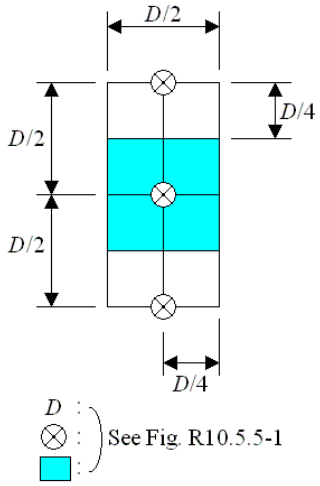


Fig. R10.5.5-3

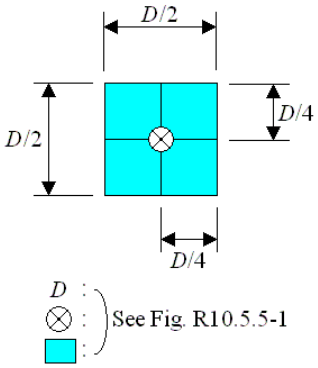


Fig. R10.5.5-4

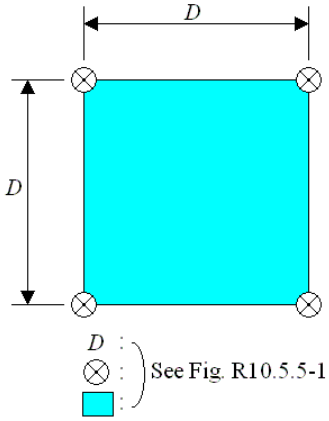
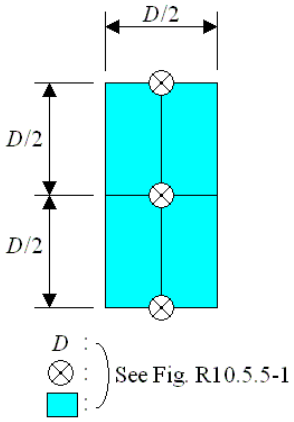


Fig. R10.5.5-5



7 The wording "fire hazard portions of internal combustion machinery" specified in **10.5.5-3, Part R of the Rules** means hot surfaces such as exhaust pipes without insulation or with insulation likely to be removed frequently for maintenance, and high pressure fuel oil systems installed nearby the hot surfaces. In general diesel engines, it means the area on top of the engine. Where the fuel oil injection pumps are located in sheltered position such as under the steel platform, the pump need not be protected by the fire-fighting system.

8 The wordings "boiler fronts" and "the hazardous portions of incinerators" specified in **10.5.5-3, Part R of the Rules** mean, in general, the part around burners without insulation or with insulation likely to be removed frequently for maintenance. In this connection, inert gas generators using flue gases and thermal oil heaters are to be protected by the fire-fighting system.

9 Arrangements of the fire-fighting systems required by **10.5.5-3, Part R of the Rules** are to comply with the following requirements:

(1) Pressure source components of the fire-fighting system are to be located at easily accessible positions in the event of fire outside the protected area. Electric devices for the components located within the protected space are to have the protection of IP44 and above.

(2) Nozzles and piping of the fire-fighting system are not to prevent the access to the engine or machinery for routine maintenance and are, in general, to be located outside the operation area of overhead hoists, etc. For the arrangements of nozzles, considerations are to be given to surrounding obstructions which may affect the release of the fire-fighting system.

(3) Considerations are to be given to the influence of water mist on the installations essential for ship's operation for the purpose that the release of the fire-fighting system is not to be result in loss of electrical power or reduction of the maneuverability of the ship. The installations having the protection of IP44 and above or those verified by the tests deemed as appropriate by the Society, may be considered those which may not be affected by water mist.

(4) The influence on the capabilities of the fire-fighting system due to ventilation is to be minimized. Consideration is to be given

so that ventilation systems, which are automatically stopped or shut off in connection with the activation of fire-fighting systems, will not lead to the stoppage of any engines.

(5) In case of using fresh water for the fire-fighting system, the following **(a)** or **(b)** is to be provided to ensure continuously supplying fresh water for at least 20 *minutes*.

(a) A dedicated fresh water tank.

(b) A low level alarm system, where the fresh water is supplied from tanks for other purpose. The pre-set water level of the alarm is to have sufficient allowance except that such a system as a fresh water generator can supply fresh water in need.

(6) Where a water supply for the fire-fighting system is common to other installations, the water supply is to be so designed that it can be isolated from other installations at an easily accessible position in the event of fire in the protected area.

(7) Considerations are to be given to the design so that the fire-fighting system will not affect the fixed fire-extinguishing system required for the machinery spaces by the provisions of **10.5.1** to **10.5.3, Part R of the Rules**. For example, where a fixed foam fire-extinguishing system is to be provided for the protected space, the water supply to the local application system is stopped when the fixed foam system is used.

10 The "visual and distinct audible alarm" required in **10.5.5-4, Part R of the Rules** is to be provided to, in general, each of the protected area and be distinguishable from other alarms in the protected space.

11 The alarms in **-10** above are to be distinguishable from fire alarms regardless that fire detectors are used as a part of the fire detecting and alarm systems for machinery spaces of category *A* required in **7.4, Part R of the Rules** in accordance with the provisions of **-6** above, where automatic release is required in **10.5.5-2, Part R of the Rules**.

12 Where the fire-fighting system is installed with the automatic release system required in **10.5.5-2, Part R of the Rules**, caution plates are to be displayed outside each entrances of the protected space stating the type of medium used and the possibility of automatic release.

R10.6 Fire-extinguishing Arrangements in Control Stations, Accommodation and Service Spaces

R10.6.2 Spaces Containing Flammable Liquid

1 The requirements of **10.6.2, Part R of the Rules** need not apply to spaces for the storage of cargo samples, when such spaces are positioned within the cargo area onboard tankers.

2 The wording "appropriate fire-extinguishing arrangement approved by the Society" means, in principle, the fire-extinguishing arrangement specified in **10.6.2-1** or **10.6.2-3, Part R of the Rules** as appropriately.

R10.6.3 Deep-fat Cooking Equipment

1 The wording "deep-fat cooking equipment" specified in **10.6.3, Part R of the Rules** means, in general, a fixed type cooking appliance in which cooking greases in depth are used.

2 The wording "extinguishing system tested to an international standard acceptable to the Society" required in **10.6.3(1), Part R of the Rules** means a fire extinguishing system which have passed a test of organizations authorized by the Administration or deemed appropriate by the Society in accordance with *ISO* 15371:2009 on "Ships and marine technology - Fire-extinguishing systems for protection of galley cooking equipment".

R10.7 Fire-extinguishing Arrangements in Cargo Spaces

R10.7.1 Fixed Fire-extinguishing Systems for General Cargo

1 With respect to the provisions of **10.7, Part R of the Rules**, for container cargo holds fitted with partially weathertight hatch covers in accordance with the provisions of **14.6.7, Part 1, Part C of the Rules**, closing appliances for such holds may be omitted, provided that the amount of carbon dioxide is increased in accordance with the provisions of **R25.2.2-5**.

2 Refrigerated cargo carriers are, in principle, to be provided with the fixed fire-extinguishing systems specified in **10.7, Part R of the Rules**.

3 If a fixed high-expansion foam fire-extinguishing system is provided in any other space than a machinery space, the requirements of **Chapter 26, Part R of the Rules** may be applied.

4 The wording "effective means of closing all ventilators and other openings" specified in **10.7.1-2, Part R of the Rules** means

the followings:

(1) Steel hatch covers provided with gaskets and clamping devices which can be made weather-tight without using hatch tarpaulins.

(2) Ventilators provided outside the cargo holds, readily accessible and fitted with dampers or steel weather-tight covers at a height not more than 150 *cm* above the floor. In this case, the dampers are to have steel to steel contact with the collar plate of the ventilator.

(3) Small hatch openings or openings provided within deckhouse provided with steel weather-tight covers or doors to protect such openings.

5 Vegetable oil, latex and molasses are regarded as "cargoes which constitute a low fire risk" referred in **10.7.1-2, Part R of the Rules**. For other cargoes carried in bulk, reference is to be made to the "*International Maritime Solid Bulk Cargoes (IMSBC) Code, appendix 1, entry for coal*" (as amended) and the latest version of "*Lists of solid bulk cargoes for which a fixed gas fire-extinguishing system may be exempted or for which a fixed gas fire-extinguishing system is ineffective*" (*MSC*.1/*Circ*.1395).

6 With respect to the provisions of **10.7.1-2, Part R of the Rules**, non-combustible cargoes, such as materials listed in paragraph 1 of Annex 2 to the *FTP* Code, need not be mentioned on the list of cargoes for the exemption fixed fire-extinguishing systems.

R10.7.2 Fixed Fire-extinguishing Systems for Dangerous Goods

1 With respect to the provisions of **10.7.2, Part R of the Rules**, where a ship engaged in the carriage of dangerous goods on deck or in a part of cargo spaces, all cargo spaces are to be provided with a fixed gas fire-extinguishing system complying with the provisions of **10.7, Part R of the Rules** or with a fixed fire-extinguishing system which gives protection deemed as equivalent by the Society.

2 With respect to the requirements of **10.7.2, Part R of the Rules**, a means of water supply complying with the requirements of **19.3.1-2, Part R of the Rules** may be considered as a "fire-extinguishing system which gives equivalent protection" specified in **10.7.2, Part R of the Rules** for the cargoes listed in Table 2 of the latest version of *MSC*.1/*Circ*.1395.

R10.7.3 Firefighting for Ships Designed to Carry Containers on or above the Weather Deck

The wording "deemed appropriate by the Society" specified in **10.7.3-2(1), Part R of the Rules** means to comply with the requirements of "*Guidelines for the Design, Performance, Testing and Approval of Mobile Water Monitors Used for the Protection of On-deck Cargo Areas of Ships Designed and Constructed to Carry Five or More Tiers of Containers on or above the Weather Deck*" (*MSC*.1/*Circ*.1472) and to be approved by organizations authorized by the Administration or deemed appropriate by the Society.

R10.8 Cargo Tank Protection

R10.8.1 Fixed Deck Foam Systems

1 With respect to the requirements of **10.8.1, Part R of the Rules**, the fire pumps or the emergency fire pump required in **10.2, Part R of the Rules** may be utilized as pumps for fixed deck foam systems provided that those pumps have sufficient capacity for supplying both the deck foam systems and the water supply systems as required.

2 With respect to the provisions of **10.8.1, Part R of the Rules**, in cases where pipe trunks that enclose cargo pipes, etc. are situated on top of tank decks, the following are to be complied with:

(1) The pipe trunk is to be protected by a fixed fire-extinguishing system in accordance with **10.9, Part R of the Rules**. This extinguishing system is to be operable from a readily accessible position outside the pipe trunk;

(2) The pipe trunk is not considered part of the cargo tanks deck area;

(3) The area of the pipe trunk does not need to be included in the cargo tank deck area specified in **34.2.2-1(1), Part R of the Rules**;

(4) Lighting in the pipe trunk is to be in accordance with **4.5.10(2), Part R of the Rules**;

(5) The pipe trunk is to be provided with a system for the continuous monitoring of the concentration of hydrocarbon gases in accordance with **4.5.10(3), Part R of the Rules**; and

(6) If the pipe trunk contains valves, pumps or any other instruments that possibly may become a source of flammable gas, this area is to satisfy the other provisions that are applied to cargo pump-rooms in addition to **(1)** to **(5)**. However, pipes and flanges do not need to be considered as instruments that possibly may become a source of flammable gas.

R10.9 Protection of Cargo Pump Rooms

R10.9.1 Fixed Fire-Extinguishing Systems

For the application of **10.9.1(1)(a), Part R of the Rules**, alarms to warn of the release of fire-extinguishing medium are to be in accordance with the followings.

(1) Pneumatic operated alarms

CO_2 operated alarms are not to be used. Air operated alarms may be used provided the air supply is clean and dry.

(2) Electrically operated alarms

The arrangements are to be such that the electric actuating mechanism is located outside the pump room except where the alarms are certified intrinsically safe.

R10.9.3 Portable Fire Extinguishers

With respect to the requirements given in **10.9.3, Part R of the Rules**, the type of portable fire extinguisher has to correspond to the Class *B* ones specified in note (2) of **Table R10.3.2-1**.

R10.10 Fire-fighter's Outfits

R10.10.4 Fire-fighter's Communication

1 With respect to the provisions of **10.10.4, Part R of the Rules**, such "two-way portable radiotelephone apparatus" are to comply with following **(1)** and **(2)**:

(1) To be of certified safe type suitable for use in zone 1 hazardous areas, as defined in *IEC* Publication 60079.

(2) The minimum requirements in respect to the apparatus group and the temperature class of those are to be consistent with the most restrictive requirements for the hazardous area zone on board which is accessible to a fire party.

2 New, additional or replaced two-way portable radiotelephone apparatus for fire-fighter communication installed on or after 1 July 2020 on board ships for which the date of contract for construction is before 1 July 2020, those are to comply with **-1**.

R11 STRUCTURAL INTEGRITY

R11.3 Structure

R11.3.1 Structure of Aluminium Alloy

The wording "structures deemed non-load bearing" specified in **11.3.1(1), Part R of the Rules** means, for example, partition walls.

R11.4 Machinery Spaces of Category *A*

R11.4.1 Crowns and Casings

Notwithstanding the provisions of **11.4.1, Part R of the Rules**, the crowns and casings exposed to the open air need not be insulated.

R11.5 Overboard Fittings

R11.5.1 Materials of Overboard Fittings

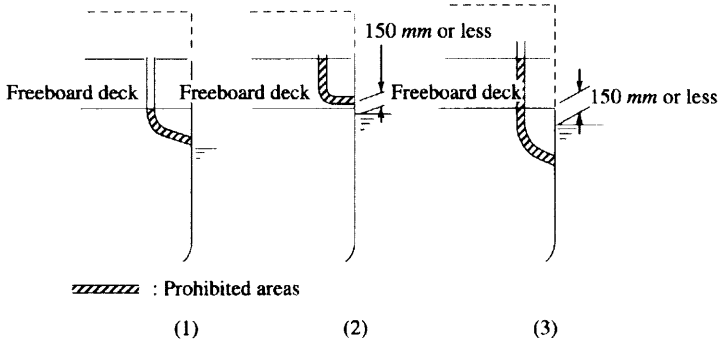
The parts where the use of materials readily rendered ineffective by heat (PVC, FRP, aluminium alloys, lead, copper and copper alloys) is prohibited for overboard scuppers and sanitary discharges specified in **11.5.1, Part R of the Rules** are those in the following **(1)**, **(2)** and **(3)**:

(1) The parts of pipes for scuppers below the freeboard deck and sanitary discharges having open ends on the shell plating below the freeboard deck (See **Fig. R11.5.1-1(1)**).

(2) In case where scuppers and sanitary discharges have open ends on the shell plating above the freeboard deck with their lower edges located at 150 *mm* or less above the load line, the parts of pipes in the spaces having such openings (See **Fig. R11.5.1-1(2)**).

(3) In case of **(1)** above, if the distance between the freeboard deck and the load line is 150 *mm* or less, the parts of pipes in the spaces directly above the freeboard deck (See **Fig. R11.5.1-1(3)**).

Fig. R11.5.1-1



R11.6 Protection of Cargo Tank Structure against Pressure or Vacuum

R11.6.1 General

The performance, installation procedures, etc. of pressure/vacuum valves (hereinafter referred to as "*PV* valves") specified in **11.6.1(1), Part R of the Rules** are to comply with the following requirements. The wording "the procedure deemed appropriate by the Society" in **11.6.1(1), Part R of the Rules** means the procedure specified in **Chapter 7, Part 6 of "Guidance for the Approval and**

Type Approval of Materials and Equipment for Marine Use". Approved *PV* valves are made public on "**List of approved materials and equipment**".

(1) Performance

(a) *PV* valves are to be set at a pressure within the ranges from 0.021 *MPa* to 0.014 *MPa* on the pressure side and -0.003 *MPa* to -0.007 *MPa* on the vacuum side. Provided, however, that special reinforcements are made for the scantlings of cargo tanks, the set pressure on the pressure side may be of an appropriate value not exceeding 0.07 *MPa*.

(b) A *PV* valve installed on a vent branch line of the common venting system is to be such that the discharge outlet is separated from the suction inlet.

(2) Installation Procedure

(a) In case where a *PV* valve is fitted on a vent branch pipe of the common venting system, the discharge outlet is to be fitted to the vent branch pipe. The suction inlet is not to be fitted to the vent branch pipe to the cargo tanks.

(b) A means is to be provided for easy access to the valves.

(3) Alternative to *PV* valves

In case where an exclusive automatic pressure valve and an exclusive automatic vacuum valve are provided in combination, such an arrangement may be regarded as that provided with a *PV* valve. In this case, the exclusive automatic pressure valve and the exclusive automatic vacuum valve are to comply with the requirements for the discharge side or the suction side of the *PV* valve specified in **(1)** and **(2)** respectively.

R11.6.2 Openings for Small Flow by Thermal Variations

The area around the air intakes and openings specified in **11.6.2(2), Part R of the Rules** is defined as a hazardous area in accordance with *IEC* 60092-502:1999.

(1) Areas on open deck, or semi-enclosed spaces on open deck, within 3 *m* of cargo tank ventilation outlets which permit the flow of small volumes of vapor or gas mixtures caused by thermal variation are defined as Zone 1 as specified by *IEC* 60092-502:1999 para 4.2.2.7.

(2) Area within 2 *m* beyond the zone specified in **(1)** above are to be considered Zone 2 (as opposed to 1.5 *m as* specified by *IEC* 60092-502:1999 para 4.2.3.1).

(3) Electrical equipment or cables are not normally to be installed in hazardous areas. Where essential for operational purposes, electrical equipment may be installed in accordance with *IEC* 60092-502:1999 (*see* **4.2.4, Part H**).

R11.6.3 Safety Measures in Cargo Tanks

1 The design, arrangement, etc. of high level alarms and level detecting devices of an overflow control system specified in **11.6.3-1, Part R of the Rules** are to comply with the following requirements. The wording "procedure deemed appropriate by the Society" in **11.6.3-1, Part R of the Rules** means the procedure specified in **Chapter 7, Part 6 of "Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use"**. Approved high level alarms and level detecting devices are made public on "**List of approved materials and equipment**".

(1) Performance

(a) Alarms are to be activated in manned spaces.

(b) The alarm system is to be independent of the level sounding system.

(c) The alarm system may operate only when cargo handing is being carried out.

(2) Installation procedures

(a) A means is to be provided for easy access.

(b) In case where the alarm is installed in a position from which cargo handing cannot be stopped, an appropriate means is to be provided to pass the alarm to a position from which cargo handling can be stopped.

2 Venting arrangement piping damage need not be considered as "the event of failure of the arrangements in **11.6.1(2)**" specified in **11.6.3-2, Part R of the Rules**.

3 "A secondary means of allowing full flow relief of vapour, air or inert gas mixtures" specified in **11.6.3-2, Part R of the Rules** is to comply with the following requirements:

(1) The venting arrangements specified in **11.6.1(2), Part R of the Rules**, the rupture disks or the pressure-vacuum breaking devices may be used as a secondary means. The rupture disk is to be of a type approved by the Society in accordance with the provisions of **Chapter 7, Part 6 of "Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use"**.

(2) The height requirements specified in **4.5.3-4(1)** and **11.6.2, Part R of the Rules** and the requirements for devices to prevent the passage of flame specified in **4.5.3-3, Part R of the Rules** are not applicable to the openings of a secondary means provided that their settings are above the pressure relief setting of and below the vacuum relief setting of the venting arrangements required by **(1)** and **(2)** of **11.6.1, Part R of the Rules**, namely, that a secondary means does not work during the venting arrangements required by **(1)** and **(2)** of **11.6.1, Part R of the Rules** are at normal operation.

(3) For tankers which are equipped with inert gas systems complying with the requirements specified in **4.5**, **11.6** and **Chapter 35, Part R of the Rules**, which carry out unloading operation under the conditions that the masthead isolation valve for free flow type is closed and inert gas is supplied into cargo tanks, the secondary means may be arranged taking into account that the operation supplying inert gas serves as the primary under-pressure protection as specified in **11.6.1(2), Part R of the Rules**.

4 The pressure monitoring system specified in **11.6.3-2, Part R of the Rules** is to comply with the following requirements in addition to the requirements specified in **11.6.3-2, Part R of the Rules**:

(1) The pressure monitoring system is to be of an approved type by the Society in accordance with the provisions of **Chapter 7, Part 6 of "Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use"**.

(2) The set pressure of an alarm facility on the pressure side is to be above the pressure setting of the arrangements required by **11.6.1(2), Part R of the Rules** but is not to exceed the test pressure of the cargo oil tank unless specially approved by the Society.

(3) The set pressure of an alarm facility on the vacuum side is to be below the vacuum setting of the arrangements required by **11.6.1(2), Part R of the Rules** but is not to be less than -0.007 *MPa* unless specially approved by the Society.

(4) Any stop valves or other shut-off devices are, in general, not to be fitted between a cargo oil tank and the pressure sensor. Where stop valves are fitted, they are to be provided with locking arrangements, and there is to be a clear visual indication of the operational status of the valves.

(5) The pressure sensor is to be designed and fitted with to avoid clogging by particle contaminants and to be easily calibrated and maintained.

(6) The alarm settings are to be fixed and not arranged for blocking or adjustment in operation specified in **11.6.1(2), Part R of the Rules**.

(7) Notwithstanding the requirement in the preceding **(6)**, for ships that carry different types of cargo and use P/V valves with different settings, one setting for each type of cargo, the settings may be adjusted to account for the different types of cargo. However, the procedure of changing of the set pressure is to be clearly specified in the operation manual of the pressure monitoring system.

5 For determining the size of the pressure/vacuum breaking devices specified in **11.6.3-4, Part R of the Rules**, calculation of pressure losses is to be carried out taking the following parameters into account:

(1) loading/discharging rates;

(2) gas evolution;

(3) pressure loss across devices, taking the resistance coefficient into account;

(4) pressure loss in the vent piping system;

(5) pressure at which the vent opens if a high velocity device is used;

(6) density of the saturated vapour/air mixture; and

(7) to compensate for possible fouling of a flame arrester, 70% of its rated performance is to be used in the pressure drop calculation of the installation.

6 In case where liquid-filled type devices are provided as the pressure/vacuum breaking devices specified in **11.6.3-4, Part R of the Rules**, a heating system is to be provided if such liquid is likely to freeze.

R12 NOTIFICATION OF CREW AND PASSENGERS

R12.1 General

R12.1.2 General Emergency Alarm System

For a general emergency alarm system specified in **12.1.2, Part R of the Rules**, reference is to be made to 7.2.1 of the International Life-Saving Appliance (*LSA*) Code (*Res. MSC.*48(66)).

R12.1.3 Public Address Systems

For a public address system specified in **12.1.3, Part R of the Rules**, reference is to be made to 7.2.2 of the International Life-Saving Appliance (*LSA*) Code (*Res. MSC.*48(66)).

R13 MEANS OF ESCAPE

R13.1 General

R13.1.1 Purpose

1 The escape routes specified in **13.1.1(1), Part R of the Rules** are routes for escape and also for access. Accordingly, doors and locking arrangements in way of escape routes are such that it does not obstruct these two objectives (escape and access) and are to be operable from both sides without any keys. Notwithstanding above, these arrangements such that keys are needed only for access may be accepted provided that such keys are prepared for ready use.

2 With respect to the requirements specified in **13.1.1(1), Part R of the Rules**, in cases where overhead hatches are used as escape routes, such hatches are to comply with the following **(1)** and **(2)**:

(1) Hatch securing devices are to be of a type which can be opened from both sides.

(2) The maximum force needed to open the hatch cover is not to exceed 150 *N*. The use of a spring equalizing, counterbalance or other suitable device on the hinge side to reduce the force needed for opening is acceptable.

R13.3 Means of Escape from Control Stations, Accommodation and Service Spaces

R13.3.1 General Requirements

1 With respect to the requirements specified in **13.3.1-1, Part R of the Rules**, means of escape from spaces in which the crew is normally employed but not continuously employed may have only one means of escape. This sole means of escape is to be independent of watertight doors.

2 "Two means of escape" specified in **13.3.1-4, Part R of the Rules** are to be those which are separated each other and the escape routes are not common.

R13.3.2 Details of Means of Escape

1 With respect to **13.3.2-2, Part R of the Rules**, escape routes are to consist of one stairway protected by divisions complying with the requirements of **9.2, Part R of the Rules** in combination with a stair or escape hatch which is capable of being operated from both sides and directly leads to the open deck from the places concerned. (See **Fig. R13.3.2-1**)

2 Means of escape above the lowest open deck specified in **13.3.2-3, Part R of the Rules** are to be in accordance with either of the following requirements:

(1) Escape routes are to consist of two stairways protected by the divisions complying with the requirements of **9.2, Part R of the Rules** in combination with doors in outer boundaries on starboard side and portside of the deckhouse at least two levels from where the lifeboats and life rafts embarkation area can be easily reached. (See **Fig. R13.3.2-2**)

(2) Escape routes are to consist of one stairway protected by the divisions complying with the requirements of **9.2, Part R of the Rules** in combination with at least one door in outer boundary of the deckhouse at each level. (See **Fig. R13.3.2-1**)

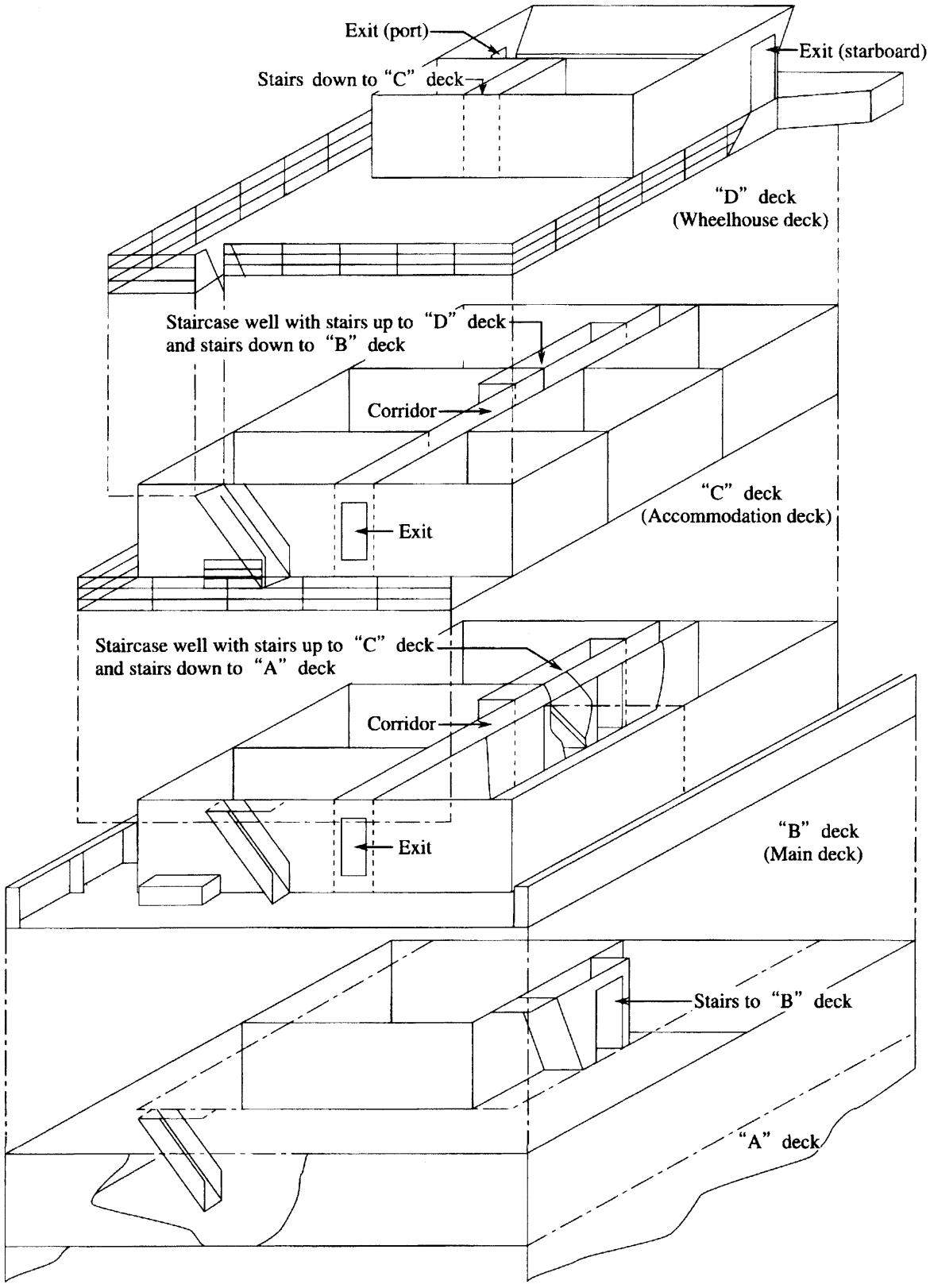
3 The width, number and continuity of escape routes specified in **13.3.2-5, Part R of the Rules** may be accepted even where the lifeboats and liferafts embarkation area can not directly be reached, provided that such area can be reached through corridors and stairways in safe ways. Such arrangement as to reach the area only by passing through the cabins or using vertical ladders is to be prohibited.

4 With respect to the requirements of **13.3.2-2** and **-3**, **Part R of the Rules**, the "lowest open deck" is an "open deck" as defined in **9.2.3-2(10)** and **9.2.4-2(10)**, **Part R of the Rules** at the lowest height from baseline in way of accommodation spaces.

R13.3.3 Emergency Escape Breathing Devices

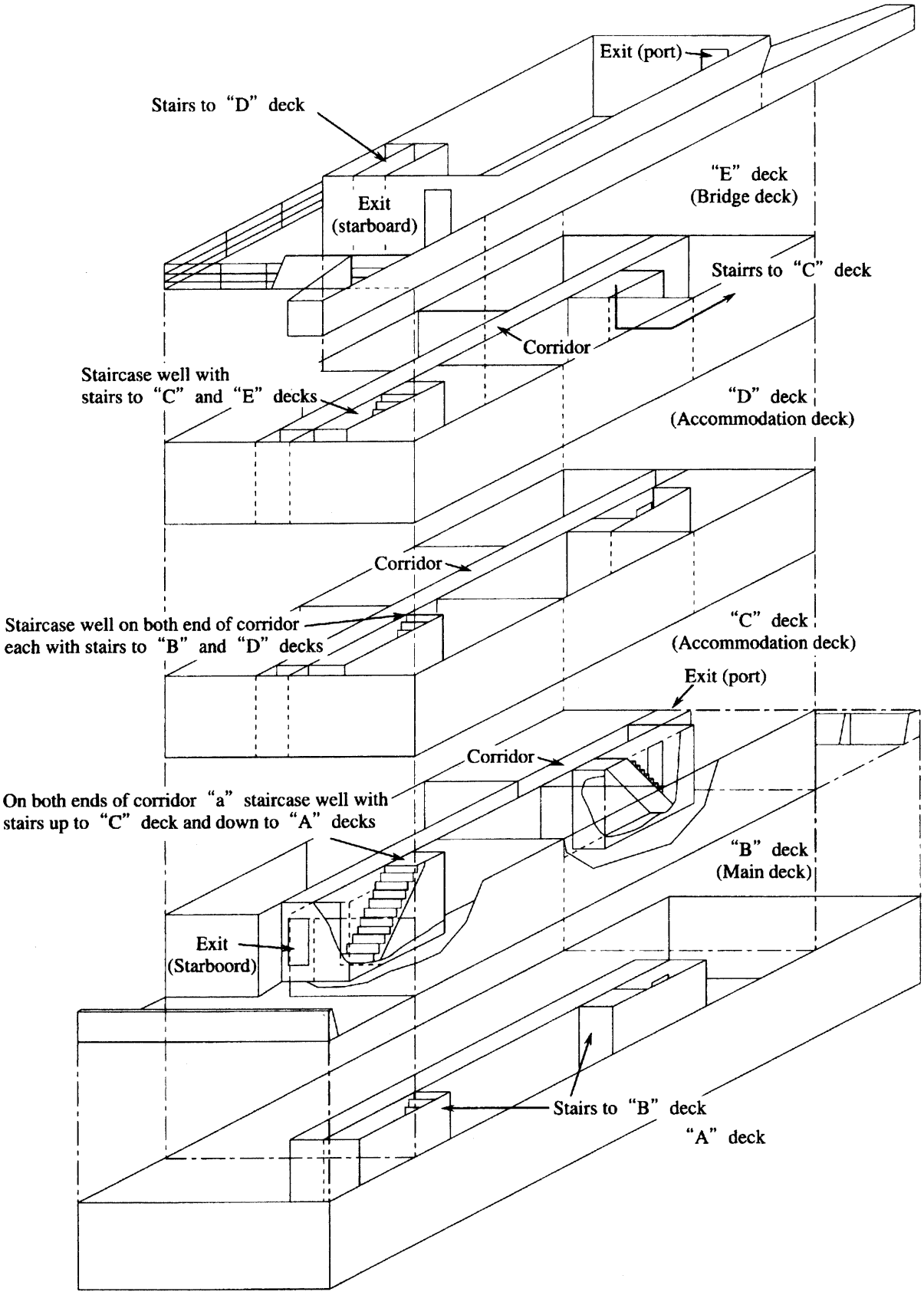
With respect to the requirements of **13.3.3, Part R of the Rules**, the emergency escape breathing devices (hereinafter, referred to as "*EEBD*s") are to be located along the escape routes from the spaces with difficulty to reach a safe position or the spaces where the crew may have employed during the fire and, in principle, two sets of these devices are to be located in fire control stations and/or internal stairway enclosures which may be used as an escape route. In addition to the above at least one set of spare device is to be kept onboard.

Fig. R13.3.2-1



Where one set of stairways protected by divisions is provided

Fig. R13.3.2-2



Where two sets of stairways protected by divisions are provided

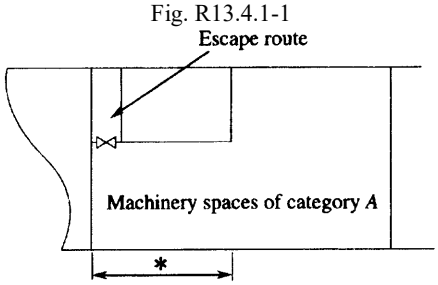
R13.4 Means of Escape from Machinery Spaces

R13.4.1 Escape from Machinery Spaces of Category *A*

1 "Ladder" specified in **13.4.1, Part R of the Rules** means stairways and ladders.

2 With respect to the requirements of **13.4.1, Part R of the Rules** to the cases where machinery spaces of category *A* are recessed in toward the stern, one of escape routes from the required machinery space of category *A* is to be provided at the aft of the recess. (See **Fig. R13.4.1-1**) However, in case where the length of the recessed part (portion with asterisk in **Fig. R13.4.1-1**) is 7 *m* or less, this escape route is not required.

Fig. R13.4.1-1



3 With respect to the requirements of **13.4.1, Part R of the Rules** to the cases where a safe escape route from the lower part of the space is provided by means of the special arrangement or dimensions of the machinery space, the protected enclosure may be dispensed with.

4 It is not desirable to use ro-ro or vehicle spaces as a part of the escape routes from the machinery space of category *A* to the open deck required in **13.4.1, Part R of the Rules**. In case where such an arrangement is unavoidable, the following requirements are to be complied with:

(1) The escape route through ro-ro or vehicle spaces is to be restricted to one and other routes are to be arranged either through spaces other than the above route or through protected enclosures. The protected enclosures are to be provided with insulation in accordance with the requirements of **Tables R9.1** and **Tables R9.2, Part R of the Rules** as corridor.

(2) The escape route through ro-ro or vehicle spaces is to be as short as possible, and a corridor is to be secured by permanent and rigid construction so that passage may not be hampered by cargo.

5 For the protected enclosure specified in **13.4.1(1), Part R of the Rules**, the following requirements are to be complied with:

(1) In case where doors are provided in midway of the protected enclosure in addition to the lower part door, these doors are to be of self-closing type and of the same fire integrity standards as the protected enclosure required in **9.2.3, Part R of the Rules**.

(2) In principle, the protected enclosure is to be provided with insulation on the outside such that heat is not transferred into.

6 With respect to the requirements specified in **13.4.1, Part R of the Rules**, doors on escape routes provided in boundaries facing control stations, accommodation or service spaces are, in general, to comply with the requirements of **13.3.1-5, Part R of the Rules**. Details of means of escape except ladders in protected enclosure are to be in accordance with **33.2, Part R of the Rules**.

7 With respect to the requirements of **13.4.1, Part R of the Rules**, inclined ladders and stairways in machinery spaces being part of, or providing access to, escape routes but not located within a protected enclosure are not to have an inclination greater than 60° and are not to be less than 600 *mm* in clear width. Such requirement need not be applied to ladders and stairways not forming part of an escape route, only provided for access to equipment or components, or similar areas, from one of the main platforms or deck levels within such spaces.

8 A "safe position" specified in **13.4.1(1), Part R of the Rules** is any space, such as steering gear spaces where hydraulic oils for the steering gear equipment are stowed, and vehicle and ro-ro spaces, from which access is provided and maintained clear of obstacles to the open deck. This excludes cargo spaces, lockers, storerooms, cargo pump-rooms and spaces where flammable liquids are stowed.

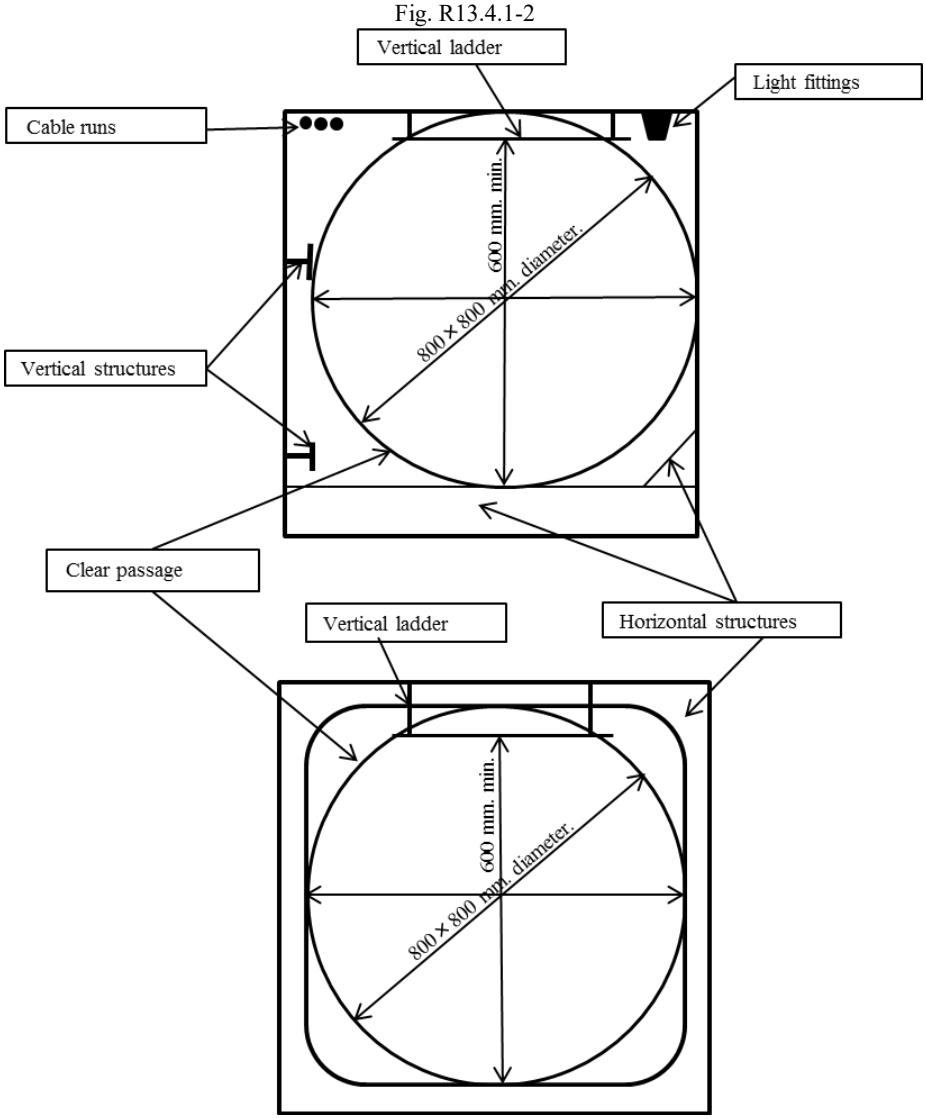
9 With respect to the requirements of **13.4.1, Part R of the Rules**, machinery spaces of category *A* may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space is to be regarded as the lowest deck level, platform or passageway within the space. At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors are to be fitted in the protected enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two

means of escape.

10 A protected enclosure providing escape from machinery spaces of category *A* to an open deck may be fitted with a hatch as means of egress from the enclosure to the open deck. The hatch is to have minimum internal dimensions of 800 *mm* x 800 *mm*.

11 With respect to the requirements of **13.4.1(1), Part R of the Rules**, internal dimensions are to be interpreted as clear width, so that a passage having diameter of 800 *mm* is available throughout the vertical enclosure, as shown in the **Fig. R13.4.1-2**, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width is not to be less than 600 *mm*.

Fig. R13.4.1-2



R13.4.2 Dispensation from Two Means of Escape

1 With respect to the requirements of **13.4.2, Part R of the Rules**, where the second means of escape is dispensed with, the means of escape is, in principle, to be of a protected enclosure.

2 The wording "emergency steering position" specified in **13.4.2, Part R of the Rules** means all steering positions other than that in the navigation bridge.

3 With respect to the requirements of **13.4.2, Part R of the Rules**, steering gear spaces which do not contain the emergency steering position need to have only one means of escape.

4 With respect to the requirements of **13.4.2, Part R of the Rules**, steering gear spaces containing the emergency steering position can have one means of escape provided it leads directly onto the open deck. Otherwise, two means of escape are to be provided but they do not need to lead directly onto the open deck.

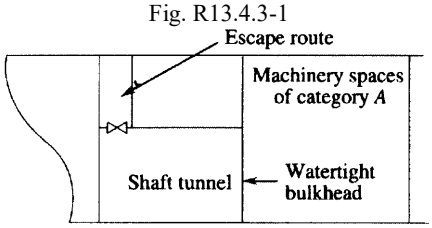
5 "Direct access to the open deck" specified in **13.4.2, Part R of the Rules**, means escape routes by the stairways or fixed ladders installed in steering gear spaces without passing through other spaces (including enclosed stairway rooms or enclosed trunks). In

addition, access doors to the other spaces are not to be provided in such escape routes.

R13.4.3 Escape from Machinery Spaces other than those of Category *A*

1 With respect to the requirements of **13.4.3, Part R of the Rules**, only one set of means of escape may be provided for the spaces which are regarded as those having little or no fire risk specified in **R9.2.3-9**. In this case, the escape route is not to pass through machinery spaces of category *A* and is to be independent of watertight doors. Where a shaft tunnel is provided, an escape route is to be provided at the aft end of the shaft tunnel. (See **Fig. R13.4.3-1**)

Fig. R13.4.3-1



2 With respect to the requirements specified in **13.4.3, Part R of the Rules**, doors on escape routes provided in boundaries facing control stations, accommodation or service spaces are, in general, to comply with the requirements of **13.3.1-5, Part R of the Rules**. Details of means of escape except ladders in protected enclosure are to be in accordance with **33.2, Part R of the Rules**.

3 With respect to the requirements of **13.4.3, Part R of the Rules**, in machinery spaces other than those of category *A*, which are not entered only occasionally, the travel distance is to be measured from any point normally accessible to the crew, taking into account machinery and equipment within the space.

R13.4.5 Escape from Machinery Control Rooms in Machinery Spaces of Category *A*

1 With respect to the requirements of **13.4.5**, **Part R of the Rules**, a "machinery control room" means a space which serves for control and/or monitoring of machinery used for ship's main propulsion.

2 With respect to the requirements of **13.4.5**, **Part R of the Rules**, a "continuous fire shelter" means a route from a machinery control room, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by **13.4.1(1)**, **Part R of the Rules**.

3 Continuous fire shelters as specified in **13.4.5**, **Part R of the Rules** are to comply with the following:

(1) The boundaries of the continuous fire shelter are to be at least "*A*-0" class divisions and be protected by self-closing "*A*-0" class doors; and

(2) The continuous fire shelter is to have minimum internal dimensions of at least 800 *mm* x 800 *mm* for vertical trunks and 600 *mm* in width for horizontal trunks, and is to have emergency lighting provisions.

4 Figures below from **Fig. R13.4.5** represent typical arrangements of the continuous fire shelters through trunks or through spaces/rooms to a location outside the machinery space, which are be considered as effective.

R13.4.6 Escape from Main Workshops in Machinery Spaces of Category *A*

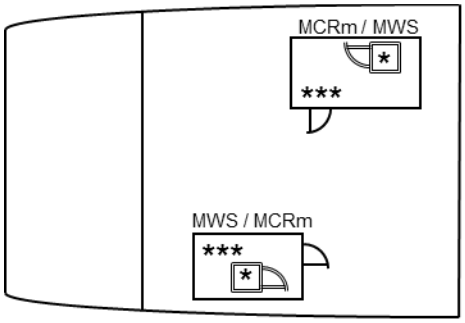
1 With respect to the requirements of **13.4.6**, **Part R of the Rules**, a "main workshop" means a compartment enclosed on at least three sides by bulkheads or gratings, usually containing welding equipment, metal working machinery and workbenches.

2 With respect to the requirements of **13.4.6**, **Part R of the Rules**, a "continuous fire shelter" means a route from a main workshop, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by **13.4.1(1)**, **Part R of the Rules**.

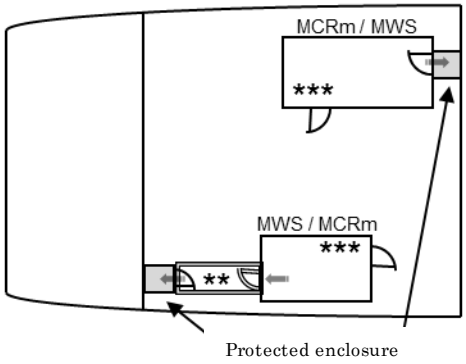
3 Continuous fire shelters as specified in **13.4.6**, **Part R of the Rules** are to comply with **R13.4.5-3**.

4 Figures below from **Fig. R13.4.5** represent typical arrangements of the continuous fire shelters through trunks or through spaces/rooms to a location outside the machinery space, which are considered as effective.

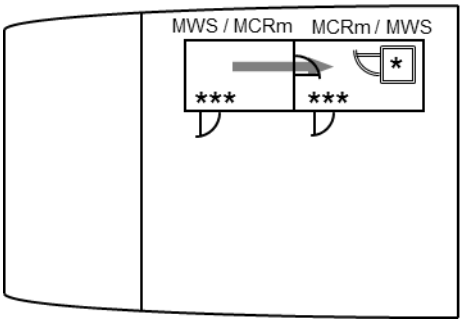
Fig. R13.4.5 Represent typical arrangements of the continuous fire shelters



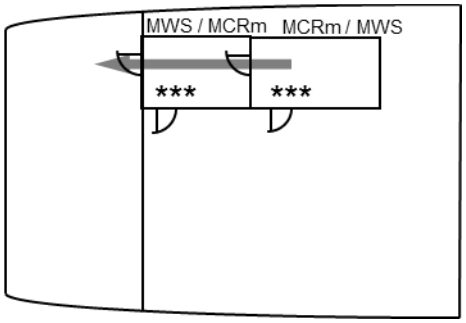
(1) Single Room Escape via Trunk



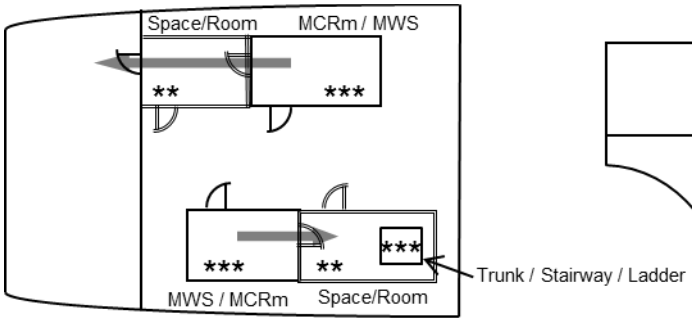
(2) Single Room Escape via Protected Enclosure



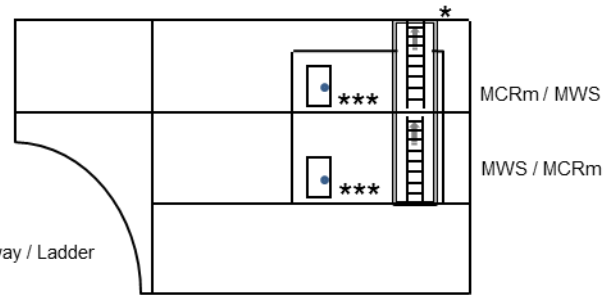
(3) Room to Room Escape via Trunk



(4) Room to Room Direct Escape



(5) Room to Room Escape via Other Space/Room



(6) Room to Room Escape via Trunk (Different Decks)

MCRm: Machinery control room
MWS: Main workshop

Double lines in the figures represent "*A*-0" class fire integrity and self-closing "*A*-0" class doors

* Vertical trunk (minimum dimensions: 800 *mm* x 800 *mm*) enclosing ladders or stairways to be at least "*A*-0" class divisions and to be protected by self-closing "*A*-0" class doors (See **Fig.R13.4.1-2**)

** Horizontal trunk (minimum width: 600 *mm*) to be at least "*A*-0"class divisions and to be protected by self-closing "*A*-0" class doors

*** Fire integrity not required

R13.4.7 Emergency Escape Breathing Devices

With respect to the requirements of **13.4.7, Part R of the Rules**, the location of *EEBD*s is to comply with the following requirements;

(1) In machinery spaces of category *A* containing internal combustion machinery used for main propulsion

(a) One *EEBD* in the engine control room, if located within the machinery space.

(b) One *EEBD* in the workshop areas. If there is, however, a direct access to an escape way from the workshop, an *EEBD* is not required.

(c) One *EEBD* on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).

(d) Notwithstanding the provisions of **(a)** to **(c)** above, different number or location may be determined by the Administration taking into consideration the layout and dimensions or the normal manning of the space.

(2) In machinery spaces of category *A* other than those of **(1)**

One *EEBD*, as a minimum, on each deck or platform level near the escape ladder constituting the second means of escape from the space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).

(3) For machinery spaces other than those of **(1)** and **(2)**, the number and location of *EEBD*s are to be determined by the Administration.

R13.5 Means of Escape from Ro-ro Spaces

R13.5.1 Arrangement of Means of Escape

1 Means of escape required in **13.5.1, Part R of the Rules** are to be so arranged that there are adequate escape routes also during loading and unloading.

2 "Ro-ro spaces where the crew are normally employed" stipulated in **13.5.1**, **Part R of the Rules** is a place where the crew are present to carry out their routine work duties, e.g. during the loading and unloading of a ro-ro deck, or during their ro-ro deck inspections whilst the vessel is underway. Ro-ro deck inspections could for instance include fire patrols, inspection of the cargo, check of bilge wells and their alarms, sounding of tanks, cargo deck cleaning, different types of maintenance work (removing of rust, painting, greasing, etc.).

3 One of "at least two means of escape" required in **13.5.1**, **Part R of the Rules** is to be a stairway and the second escape is to be a trunk or a stairway.

4 "The fore and aft ends of the ro-ro spaces" stipulated in **13.5.1**, **Part R of the Rules** are considered as the areas being within the distance equal to the breadth of the ro-ro spaces, measured at its widest point, from its forward most and aftmost point.

5 With respect to the requirements of **13.5.1**, **Part R of the Rules**, suitable signs and markings are to be provided to indicate the route to the means of escape.

R15 TRAINING MANUAL AND FIRE CONTROL PLAN

R15.2 General Requirements

R15.2.2 Fire Control Plans

1 For developing fire control plans or booklets required in **15.2.2-1, Part R of the Rules**, it is recommended to refer to *IMO* resolution *A*.952(23) "*Graphical symbols for shipboard fire control plans*" and Table 3 of *IMO* resolution *A*.1116(30) "*Escape Route Signs and Equipment Location Markings*".

2 With respect to the requirements of **15.2.2-2, Part R of the Rules**, the storage of fire control plans or a booklet is to be referred to the "Guidance concerning the location of fire control plans for assistance of shoreside fire-fighting personnel" (*MSC/Circ.*451). For tankers, chemical tankers and gas carriers, such plans or booklets are not to be located on exterior boundaries of superstructures which face cargo tanks and on the surfaces within 3 *m* from them along the side.

R15.2.3 Means of Recharging Breathing Apparatus Cylinders and Spare Cylinders

With respect to the provisions of **15.2.3, Part R of the Rules**, "a suitable number of spare cylinders" to be carried on board to replace those used for fire drills is to be at least one "set of cylinders" for each mandatory breathing apparatus required by **10.10.2** and **18.5.1(7), Part R of the Rules**. If additional spare cylinders are required by the shipboard safety management system (*SMS*), the number of spare cylinders carried on board is to be in accordance with the *SMS*. "Set of cylinders" means the number of cylinders which are required to operate the breathing apparatus. No additional cylinders are required for fire drills for breathing apparatus sets required by **Chapter 19, Part R**, **Part N** and **Part S of the Rules**, and *IMSBC Code*.

R16 OPERATIONS

R16.3 Additional Requirements for Tankers

R16.3.3 Operation of Inert Gas System

1 The wording "guidelines developed by the Society" specified in **16.3.3-4, Part R of the Rules** means *Clarification of inert gas system requirements under the Convention* (*MSC/Circ.*485) and to the *Revised Guidelines for inert gas systems* (*MSC/Circ.*353), as amended by *MSC/Circ.*387.

2 With respect to the requirements specified in **16.3.3-2** and **-3, Part R of the Rules**, in case a product containing an oxygen dependent inhibitor is carried, *MSC.1/Circ.*10, as amended, is to be applied.

R18 HELICOPTER FACILITIES

R18.2 Application

R18.2.1 Application

With respect to the requirements for areas where helicopters land or conduct winching operation in this Part, in principle, those areas are exemplified as **Fig. R18.2.1-1**, **Fig. R18.2.1-2**, **Fig. R18.2.1-3** and **Fig. R18.2.1-4**.

R18.3 Structure

R18.3.1 Construction of Steel or Other Equivalent Material

For examination of the construction of the helidecks, reference is to be made to **17.3.1-4** and **-5, Part P of the Rules**.

R18.5 Fire-fighting

R18.5.1 Fire-fighting Appliances

1 With respect to the requirements of **18.5.1(1)** and **(2), Part R of the Rules**, in cases where a portable fire extinguisher is provided, its type has to correspond to the Class *B* ones specified in note (2) of **Table R10.3.2-1**.

2 Foam application systems specified in **18.5.1(3), Part R of the Rules** are to be stored to a safe space free from a fire of the helideck.

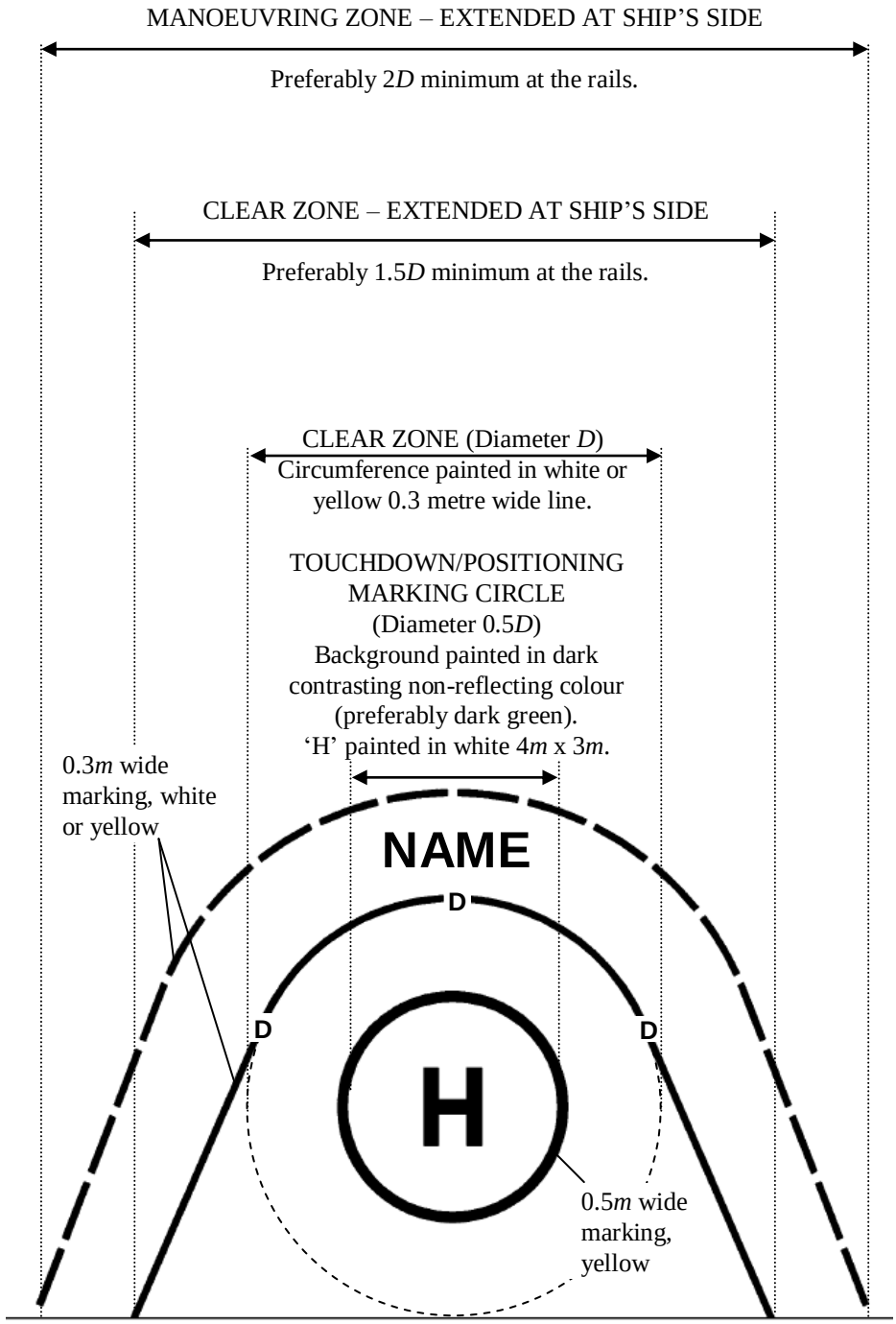
3 With respect to foam fire-fighting appliances specified in **18.5.1(3), Part R of the Rules**, reference is to be made to the "*Guidelines for the Approval of Helicopter Facility Foam Fire-fighting Appliances*" (*MSC*.1/*Circ*.1431) in addition to the requirements specified in **18.5.1(3), Part R of the Rules**.

4 In the requirements of **18.5.1(3), Part R of the Rules**, the maximum distance of delivering foam from a foam application system is to be capable of protecting area in all spaces of manoeuvring zone shown in **Fig. R18.2.1-1** to **Fig. R18.2.1-4**. Fixed foam application systems are to be capable of protecting the area specified above under the worst helicopter operable condition, i.e., the condition where the ability of a monitor to throw-in is regarded as 75% of its ability in a still air condition.

5 For the principal agent of a type deemed as appropriate by the Society specified in **18.5.1(4), Part R of the Rules**, reference is to be made to "The International Civil Aviation Organization Airport Service Manual, part 1-Rescue and Fire fighting, Chapter 8-Extinguishing Agent Characteristics, Paragraph 8.1.5-Foam Specifications Table 8-1, Level *B*".

6 In cases where the pumps used for the foam fire-extinguish system required by **18.5.1(3)** or **(6), Part R of the Rules** are also used as main fire pumps, operation of a foam fire-extinguish 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.

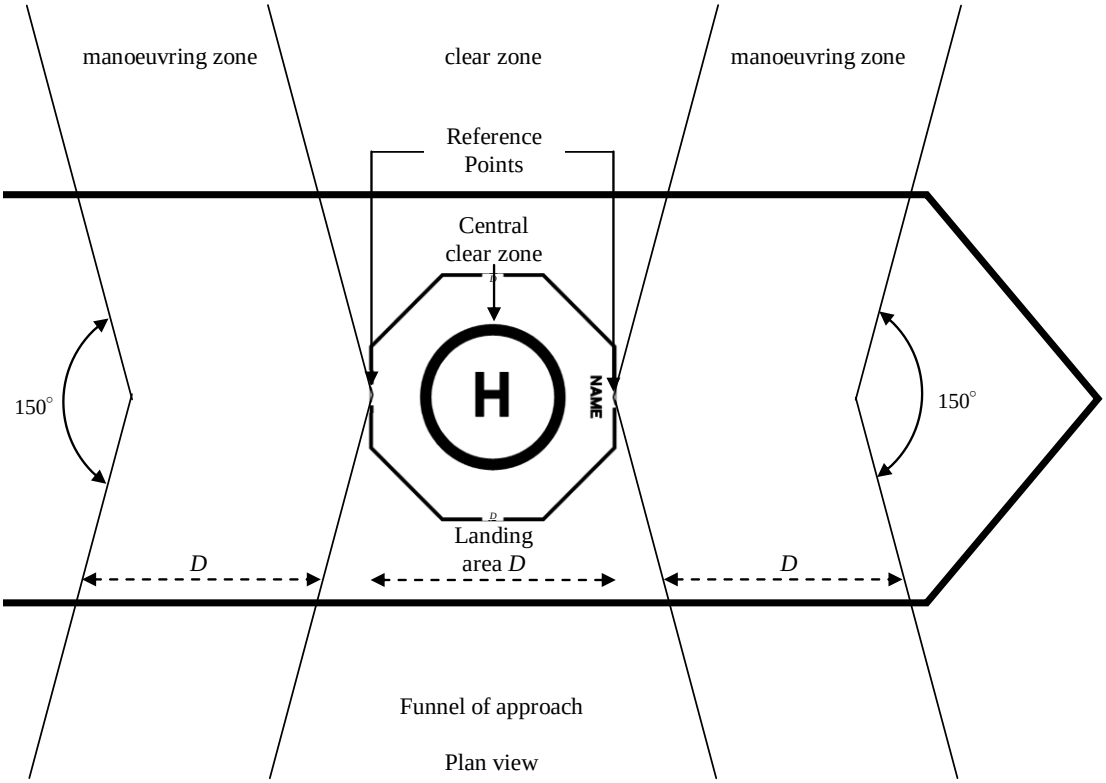
Fig. R18.2.1-1 Example of Landing Area at Ship's Side



Notes:

1. The diameter in metres, rounded down to the nearest whole number, of the clear zone 'D' is to be marked in 0.6*m* high white figures at each of the points shown, so as to be easily visible to helicopter pilots. The diameter (in metres) of the clear zone is to be equal or greater than the overall length of a visiting helicopter with rotors running.
2. Where practical, the name of the ship is to be painted in a contrasting colour (preferably white) on the inboard side of the manoeuvring zone in (minimum) 1.2 *m* high characters.

Fig. R18.2.1-2 Example of Amidships Centreline Landing Area

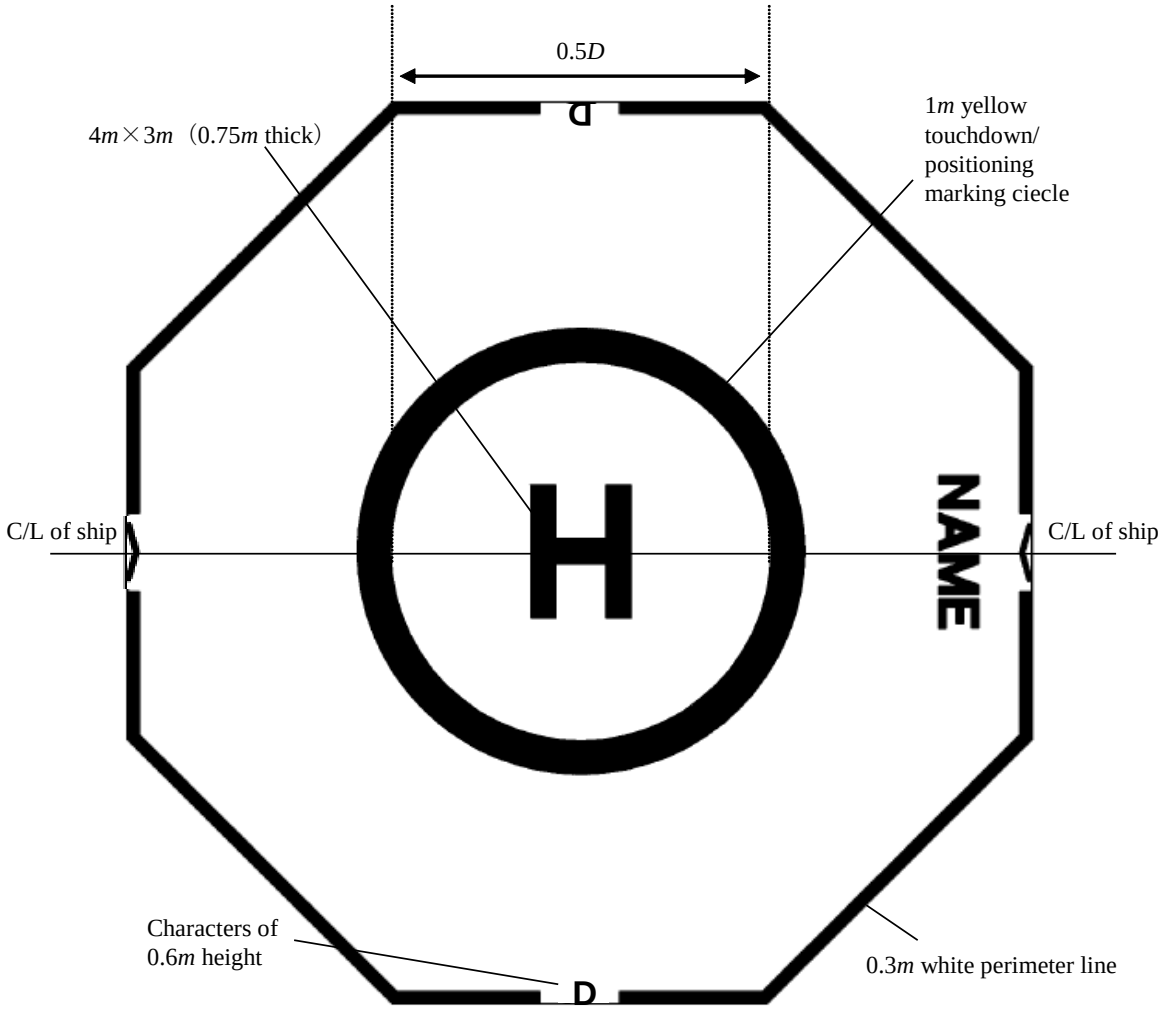


D: Helicopter largest overall dimension

Notes:

1. Where it is not possible to accommodate a ship side arrangement, it may be possible to provide a landing area located on or near to the centreline of the ship.
2. Reference points of limited obstacle areas are to be located on the centreline of the circumference of the landing area.

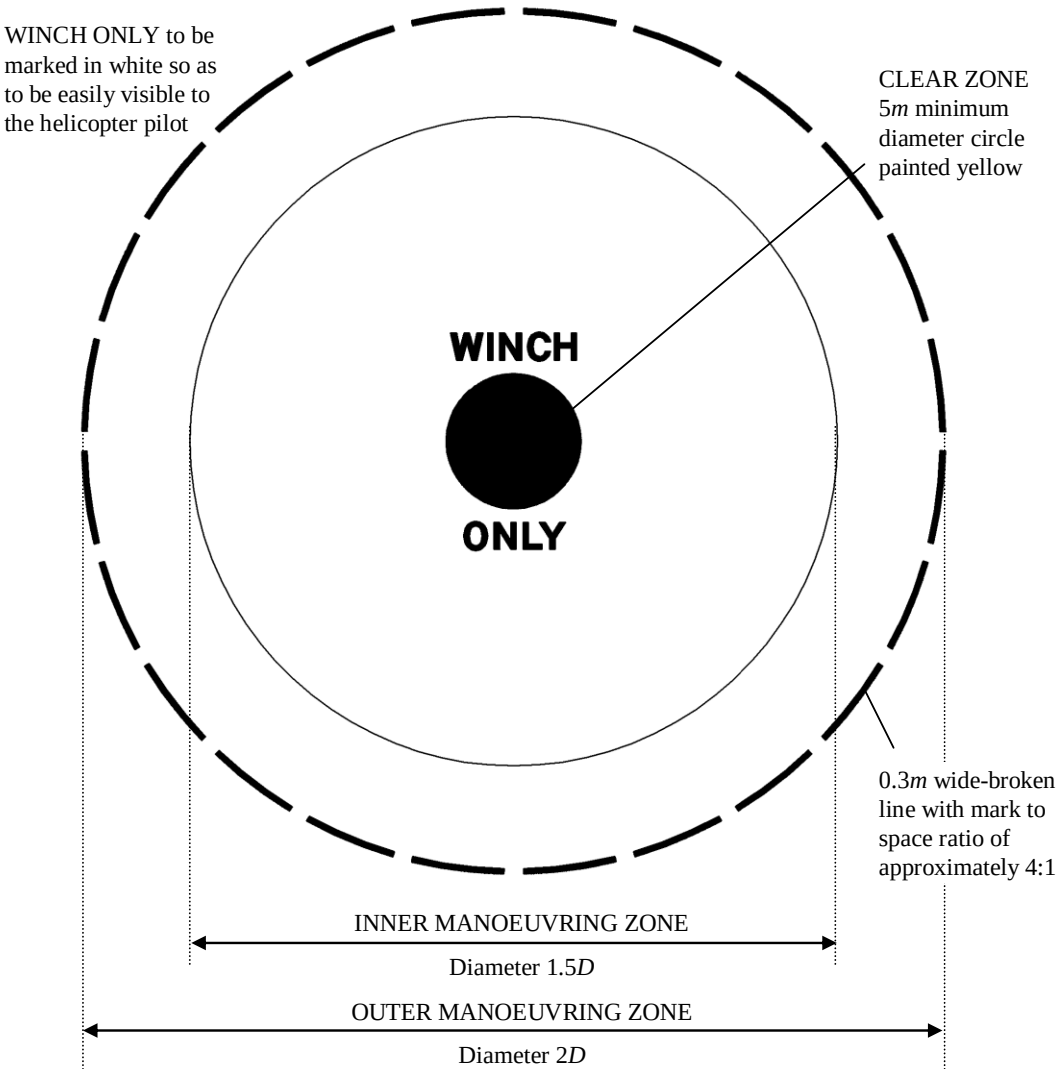
Fig. R18.2.1-3 Example of Markings for Amidships Centreline Landing Area



Notes:

1. The landing area is to be painted in a colour, preferably dark green, that contrasts clearly with the colour of the ship's deck.
2. The diameter in metres, rounded down to the nearest whole number, of the landing area 'D' is to be marked in 0.6 *m* high white figures at each of the points shown, so as to be easily visible to helicopter pilots. The diameter (in metres) of the landing area is to be equal or greater than the overall length of a visiting helicopter with rotors running.
3. Where practical, the name of the ship is to be painted in a contrasting colour (preferably white) within the landing area, aligned across the centreline. The minimum height of the painted characters is to be 1.2 *m*.

Fig. R18.2.1-4 Example of Winching Area



Notes:

1. The perimeter of the outer portion of the manoeuvring zone is to be marked with a conspicuous broken yellow line.
2. The inner portion of the manoeuvring zone may be indicated by painting a thin white line that is no more than 0.1 *m* wide.
3. Ideally, the words "WINCH ONLY" is to be painted in 2 *m* – 5 *m* high white characters.

R18.7 Helicopter Refueling and Hanger Facilities

R18.7.1 Safety Measures for Refueling and Hanger Facilities

The ventilation fans which are of "non-sparking type" specified in **18.7.1(12), Part R of the Rules** mean those ventilation fans complying with the requirements of **R4.5.4-1(2)**. For the purpose of this requirement, protection screens of not more than 13 *mm* square mesh are to be fitted in the inlet and outlet ventilation openings of the ducts fitted with such fans on the open deck.

R19 CARRIAGE OF DANGEROUS GOODS

R19.2 General Requirements

R19.2.1 Application

1 For the wording "limited quantities and excepted quantities" specified in **19.2.1-1, Part R of the Rules**, reference is to be made to chapter 3.4 and chapter 3.5 of the *IMDG* Code.

2 With respect to the requirements of **19.2.1, Part R of the Rules**, for carrying dangerous goods in container cargo holds fitted with partially weathertight hatch covers in accordance with the provisions of **14.6.7, Part 1, Part C of the Rules**, attentions are to be paid to the provisions in Section 3 of the Guidelines adopted as the *MSC/Circ.*1087.

R19.2.2 Application for Categories of Cargo Spaces

1 The wording "container cargo spaces" specified in **19.2.2(3), Part R of the Rules** means spaces equipped with cell-guides for stowage and securing of containers.

2 The wording "ro-ro spaces" specified in **19.2.2(4)** or **(5), Part R of the Rules** includes the "special category spaces" specified in **3.2.46, Part R of the Rules** and "vehicle spaces" specified in **3.2.49, Part R of the Rules**.

3 The provisions of **19.2.2(7), Part R of the Rules** cover only those cargoes listed in Group *B* of the *IMSBC* Code except cargoes of *MHB* (materials hazardous only in bulk). The carriage of other dangerous solid bulk cargoes is to be subject to acceptance by the Administrations involved.

R19.3 Special Requirements

R19.3.1 Water Supplies

1 With respect to the requirements specified in **19.3.1-1, Part R of the Rules**, the fire pumps are to be capable of being started from the navigation bridge and the fire control station. In this case, the suction and discharge valves of the fire main in machinery spaces are to be capable of being remotely controlled, or caution plates stating that these valves be kept normally open position are to be posted to call the crew's attention.

2 With respect to the requirements specified in **19.3.1-2, Part R of the Rules**, the number and position of hydrants are to be such that at least two of the required four jets of water, when supplied by single lengths of hose, reach any part of the cargo space when empty and all four jets of water, each supplied by single lengths of hose, reach any part of ro-ro spaces.

3 For container carriers, the wording "horizontal area of cargo spaces" specified in **19.3.1-3, Part R of the Rules** means the gross horizontal area of the containers of the uppermost tier.

4 The wording "suitable measures to limit the adverse effect upon stability of the added weight and free surface of water" required in **19.3.1-3, Part R of the Rules** means that the ships is to comply with the stability criteria specified in **2.2.1-1, Part U of the Rules** in any stage of accumulating water discharged from the fixed spraying or flooding system in the cargo space. The initial condition of loading is to be in accordance with the provisions specified in **An2., Annex 1.1, Part 2-2, Part C of the Rules**.

5 Fixed spraying arrangement required in **19.3.1-3, Part R of the Rules** is to be of a type approved by organizations authorized by the Administration or deemed appropriate by the Society, or equivalent. For cargo holds of open-top container ships, reference is to be made to paragraphs 9.2, 9.3 and 9.4 of *MSC/Circ.*608/*Rev.*1 "*Interim guidelines for open-top container ships*".

6 For the "provision to flood a designated under-deck cargo space with suitable specified media" specified in **19.3.1-4, Part R of the Rules**, the fixed high-expansion foam fire extinguishing systems specified in **26.3, Part R of the Rules** may be used.

7 With respect to the requirements in **19.3.1, Part R of the Rules**, reference is to be made to the requirements of **10.2.3-2(4), Part R of the Rules**.

8 With respect to the requirements of **19.3.1-5, Part R of the Rules**, for ships carrying dangerous goods designed to carry five or more tiers of containers on or above the weather deck, in cases where the mobile water monitors specified in **10.7.3-2, Part R of the Rules** and water spray system (fixed arrangement of spraying nozzles or flooding the cargo space with water) specified in **19.3.1-3, Part R of the Rules** are supplied by main fire pumps, the total capacity of the main fire pumps and the pipework diameter need only

be sufficient to supply whichever of the following is the greater:

(1) the mobile water monitors specified in **10.7.3-2, Part R of the Rules** and the four nozzles specified in **19.3.1-2, Part R of the Rules**; or

(2) the four nozzles specified in **19.3.1-2, Part R of the Rules** and the water spray system specified in **19.3.1-3, Part R of the Rules**.

However, the total capacity is not to be less than **R10.2.2-10(1)** or **(2)**, whichever is smaller.

R19.3.2 Sources of Ignition

1 Applying to the requirements in **19.3.2, Part R of the Rules**, permitted electrical installations are to be in accordance with the following.

(1) For ships carrying dangerous goods in a packaged form specified in **19.2.3(1), Part R of the Rules**, the requirements in **Table R19.3.2-1** are to apply.

(2) For ships carrying solid dangerous goods in bulk specified in **19.2.3(9)**, **(10)**, **(13)** or **(23)**, **Part R of the Rules** which may create explosive dust, the requirements in **Table R19.3.2-2** are to apply.

(3) For ships carrying solid dangerous goods in bulk specified in **19.2.3(12), Part R of the Rules** which may create explosive gas and ships carrying dangerous goods in a packaged form specified in **19.2.3(3)**, **(5)**, **(7)** (except the liquids of which flash point is less than −18 °C), **(11)** (flash point is less than 23 °C), **(15)**, **(19)** or **(23)** (evolving flammable vapour), **Part R of the Rules**, the requirements in **Table R19.3.2-3** (Classified as hazardous area by *IEC* 60092-506:2003) and **Table R19.3.2-4** (Classified as extended hazardous area by *IEC* 60092-506:2003) are to apply.

The hazardous areas specified in **Table R19.3.2-4(d)** for ships carrying flammable liquid substances having flashpoints of less than 23 °C, as specified in **19.2.3(7)**, **(15)** or **(19)**, **Part R of the Rules**, are to apply. However, enclosed spaces served by continuously forced mechanical ventilation capable of at least 6 air changes per hour may be considered as non-hazardous areas if they satisfy the following **(a)** and **(b)**:

(a) In the event of failure of the mechanical ventilation device, an alarm is to be activated in a continually manned space, such as the navigation bridge, the machinery control room, etc. In addition, all electrical installations except those permitted according to **Tables R19.3.2-1**, **R19.3.2-2** and **R19.3.2-3** (hereinafter referred to as "permitted electrical installation") are to be automatically switched off.

(b) Essential electrical equipment for the safety of the ship or its personnel is to be a permitted electrical installation which cannot be automatically switched off. However, in cases where two or more mechanical ventilation devices are installed within the enclosed space, essential equipment need not be of a permitted electrical installation type. In such cases, essential equipment not considered to be permitted electrical installations is to be interlocked so as to prevent inadvertent operation when the ventilation devices are not operational.

(4) As a rule, no portable electrical equipment is to be located in hazardous areas. Where it is unavoidable to locate the equipment in hazardous areas, they are subject to the approval of the Society.

(5) Cables led to an electrical equipment installed in a hazardous area are to comply with the requirements in **4.2.4-5, Part H of the Rules**.

(6) Cables led to an electrical equipment installed in a hazardous area and cables running through the area are to be protected by a metallic casing.

(7) Cable joints are not to be provided in hazardous areas. Where such joints are unavoidable, the joints are to be enclosed in metal-clad or impact strengthened plastic junction boxes which are deemed appropriate by the Society, or to be of encapsulated crimp sleeve cable joint.

(8) Electrical equipment which is not used while dangerous goods are carrying is to be at least IP55 of degree of protection and to be disconnected from outside of the hazardous areas by an isolating link or a lockable switch.

(9) The spaces specified in the followings **(a)** and **(b)** which have openings into adjacent hazardous areas specified in **Table R19.3.2-1** to **Table R19.3.2-3** may be considered as non-hazardous areas.

(a) Spaces where comply with all the following **i)** to **iv)**;

i) A minimum overpressure of 25 *Pa* with respect to the adjacent hazardous space is to be maintained at all points inside the space and its associated ducts at which leaks are liable to occur, all doors and windows being closed.

ii) When the space is not suitably pressurized, e.g. during initial start-up or after shut-down conditions, electrical

installations other than those permitted electrical installations are not to be energized unless the internal atmosphere is ensured as non-hazardous (the concentration of explosive gases or vapours in the space is below 30 % of the lower explosive limit) or prior purging of sufficient duration that the internal atmosphere may be considered as non-hazardous is proceeded.

iii) Monitoring device is to be provided to ensure the satisfactory functioning of pressurization of the space. In case where a flow-monitoring device is used, it is to be verified that either the pressurization level required in **i)** is maintained with any door or other opening open, or an alarm is activated if any door or other opening is not closed.

iv) In case where the pressurization level required in **i)** is not maintained, an alarm is to be activated in a continually manned space, e.g. the navigation bridge or the machinery control room, and electrical installations other than those permitted by **Table R19.3.2-1** to **Table R19.3.2-3** are to be automatically switched off. However, essential electrical equipment for the safety of the ship or personnel is to be of those permitted by **Table R19.3.2-1** to **Table R19.3.2-3** to avoid automatic switch-off.

(b) Spaces where doubly protected by gas-tight doors with self-closing devices;
In this case, watertight doors always closed and monitored their open-close condition under the voyage may be considered as gas-tight doors with self-closing devices.

(10) Areas having a gas-tight closure or a gas-tight door with self-closing devices leading to areas specified in **Table R19.3.2-4** may be considered as non-hazardous areas.

Table R19.3.2-1 Hazardous Areas and Permitted Electrical Installations (Related to **R19.3.2-1(1)**)

Hazardous areas		Permitted electrical installations
(a)	Enclosed or semi-enclosed cargo spaces, closed or open ro-ro spaces and closed or open vehicle spaces	(1) Electrical equipment of degree of protection: IP65, maximum surface temperature: 100°C, and associated cables (2) Through run cables
(b)	Inert and exhaust ventilation ducts	
(c)	Permanently fixed magazines	

Note:
Electrical equipment is to be a type for use in the atmospheres present when dangerous goods which generate explosive dust and flammable gas are transported.

Table R19.3.2-2 Hazardous Areas and Permitted Electrical Installations (Related to **R19.3.2-1(2)**)

Hazardous areas		Permitted electrical installations
(a)	Enclosed or semi-enclosed cargo spaces	(1) Electrical equipment of degree of protection: IP55, maximum surface temperature: 200°C, and associated cables (2) Certified safe type electrical equipment specified in **2.16.2, Part H of the Rules** of construction suitable for use in Zone 1 as specified in *IEC* 60079-14:2013, degree of protection: IP55, temperature class: *T*3, and associated cables (3) Through run cables
(b)	Inert and exhaust ventilation ducts	
(c)	Enclosed or semi-enclosed spaces having a direct opening (without closing devices, such as doors) into any of the spaces specified in **(a)** and **(b)**	

Notes:
1. Where cargoes which require a lower surface temperature are carried, this is to be taken into consideration.
2. The following requirements are to apply when the dangerous goods listed below are loaded in the space specified in **19.2.2(7), Part R of the Rules**.
   - Sulphur; degree of protection: IP55, temperature class: *T*4
   - Seed cakes with expellers; gas and vapour group: II*A*, temperature class: *T*3
   - Iron oxide, iron sponges; degree of protection: IP55, gas and vapour group: II*A*, temperature class: *T*2
   - Ammonium nitrate fertilizers; electrical supply circuits other than intrinsically safe circuits are to be switched off

Table R19.3.2-3 Hazardous Areas and Permitted Electrical Installations (Related to **R19.3.2-1(3)**)

Hazardous areas		Permitted electrical installations
(a)	Enclosed or semi-enclosed cargo spaces, closed or open ro-ro spaces and closed or open vehicle spaces	(1) Certified safe type electrical equipment specified in **2.16.2, Part H of the Rules** of construction suitable for use in Zone 1 as specified in *IEC* 60079-14:2013, gas and vapour group: II*B*, temperature class: *T*3, and associated cables (2) Through run cables
(b)	Inert and exhaust ventilation ducts	
(c)	Enclosed or semi-enclosed spaces having a direct opening (without closing devices, such as doors) into any of the spaces specified in **(a)** and **(b)**	
(d)	Areas on open deck or semi-enclosed spaces on open decks within 1.5 *m* of mechanical ventilation outlets of hazardous areas	

Notes:

1. Where cargoes which require a higher grading are carried, this is to be taken into consideration.
2. The following requirements are to apply when the dangerous goods listed below are loaded in the space specified in **19.2.2(7), Part R of the Rules**.
   - Aluminium ferrosilicon powder and aluminium silicon powder; gas and vapour group: II*C*, temperature class: *T*2
   - Ferrosilicon; gas and vapour group: II*C*, temperature class: *T*1
   - Zinc ashes, zinc dross, zinc residues, zinc skimmings; gas and vapour group: II*C*, temperature class: *T*2

Table R19.3.2-4 Hazardous Areas and Permitted Electrical Installations (Related to **R19.3.2-1(3)**)

Hazardous areas		Permitted electrical installations
(a)	Areas not ventilated by overpressure which have gas-tight closures or automatically closing gas-tight doors and lead to the areas specified in **Table R19.3.2-3 (a)** to **(c)**	(1) Certified safe type electrical equipment specified in **2.16.2, Part H of the Rules** of construction suitable for use in Zone 2 as specified in *IEC* 60079-14:2013, gas and vapour group: II*B*, temperature class: *T*3 and associated cables (2) Through run cables (3) Electrical equipment of the type which enclosures the absence of sparks or arcs and no part of such equipment has an operating temperature which can cause the ignition of gases or vapours of the cargoes to be carried, and associated cables (4) Electrical equipment with type of protection "n" specified in *IEC* 60079-15 and associated cables
(b)	Areas protected by gas-tight doors in accordance with **R19.3.2-1(9)(b)** (Air lock spaces)	
(c)	Areas which are 1.5 *m* beyond the areas specified in **Table R19.3.2-3 (d)**	
(d)	Enclosed spaces (bilge pump rooms, pipe tunnels, etc.) which contain sources of gas release, such as flanges, valves, and pumps	

Notes:

1. Where cargoes which require a higher grading are carried, this is to be taken into consideration.
2. The following requirements are to apply when the dangerous goods listed below are loaded in the space specified in **19.2.2(7), Part R of the Rules**.
   - Aluminium ferrosilicon powder and Aluminium silicon powder; gas and vapour group: II*C*, temperature class: *T*2
   - Ferrosilicon; gas and vapour group: II*C*, temperature class: *T*1
   - Zinc ashes, zinc dross, zinc residues, zinc skimmings; gas and vapour group: II*C*, temperature class: *T*2

2 With respect to the requirements specified in **19.3.2, Part R of the Rules**, windlasses and openings for a chain locker are to be

regarded as a source of ignition, and they are not to be installed in hazardous areas.

R19.3.3 Detection System

Where ships are provided with a sample extraction smoke detection system with respect to the requirements of **19.3.3, Part R of the Rules** and carrying cargoes giving off toxic fumes, a notice stating that the samples are to be discharged to the open air is to be permanently exhibited at the equipment.

R19.3.4 Ventilation Arrangement

1 With respect to the requirements specified in **19.3.4-1, Part R of the Rules**, the wording "vapour" means the vapour evolved from dangerous goods. In case where mechanical ventilation systems are provided in enclosed cargo spaces, the following requirements **(1)** and **(2)** are to be complied with:

(1) Mechanical ventilation systems are to be of exhaust type.

(2) Ducts are to be arranged in such a way that mixture gases can be discharged from both top and bottom of the cargo spaces. However, if specific cargoes are exclusively carried, mixture gases discharging arrangement either from top or bottom of cargo spaces may be accepted taking into account the specific gravity of the cargo vapour concerned.

2 With respect to the requirements of **19.3.4-2, Part R of the Rules**, the following requirements **(1)** and **(2)** are to be complied with:

(1) In case where electric motor driven ventilation fans are installed, the following requirements **(a)** to **(c)** are to be complied with:

(a) Where an internal motor driven type ventilating fan is installed, the motor is to be of a type approved by the Society for use in hazardous environment taking into account the requirements of the *IMDG* Code. (See **Fig. R19.3.4-1**)

(b) Where an external motor driven type ventilating fan is installed on an exposed deck, the motor is to have a protection equivalent to IP55 or upward. (See **Fig. R19.3.4-2**)

(c) Even in the case of **(b)** above, where the motor is installed in the proximity of the exhaust opening, the motor is to comply with the requirements of **(a)** above. (See **Fig. R19.3.4-3**)

(2) Ventilating fans are to comply with the requirements of **R4.5.4-1(2)** and to be of non-sparking type. For the purpose of this requirement, protection screens of not more than 13 *mm* square mesh are to be fitted in the inlet and outlet ventilation openings of the ducts fitted with such fans on the open deck.

Fig. R19.3.4-1

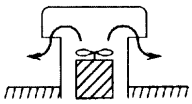


Fig. R19.3.4-2

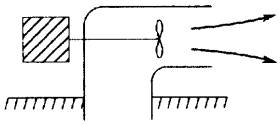
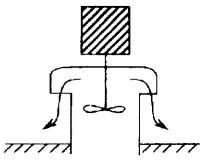


Fig. R19.3.4-3



3 Notwithstanding the provisions of **19.3.4-1, Part R of the Rules**, for cargo holds of open-top container ships, power ventilation may be required only for the lower part of the cargo hold. Such ventilation capacity may be at least 2 air changes per hour based on the empty hold volume below weather deck.

4 With respect to the provisions of **19.3.4, Part R of the Rules**, if adjacent spaces are not separated from cargo spaces by gastight bulkheads or decks, ventilation requirements of the cargo space are to apply to adjacent spaces.

R19.3.5 Bilge Pumping

1 With respect to the requirements specified in **19.3.5, Part R of the Rules**, in case where bilge pipes are led to machinery spaces, the following requirements **(1)** and **(2)** are to be complied with:

(1) Eductors are to be provided as a means of bilge discharging for cargo spaces so that bilge can be discharged overboard without passing through machinery spaces.

(2) A caution plate stating that the bilge pipes are to be blocked while dangerous goods are loaded on board are to be posted in the vicinity of the stop valves and the blank flanges required in **19.3.5-3, Part R of the Rules**.

2 The requirements of **19.3.5-4, Part R of the Rules** are to apply in accordance with the followings:

(1) This requirements may not apply to an enclosed space containing an eductor which is provided as a bilge pump required in **19.3.5-1, Part R of the Rules** and is driven by pumps provided in the spaces other than cargo spaces and such eductor space.

(2) The wording "another enclosed space" means an enclosed space other than cargo spaces and bilge pump spaces specified in **19.3.5-4, Part R of the Rules**.

(3) The doors which access to such spaces as under deck passages in container carriers may be considered equivalent to doors of reasonably gas-tight and self-closing provided that such doors are kept closed at sea and provided with means of indication on the bridge showing whether these doors are open or closed.

3 With respect to the provisions of **19.3.5-4, Part R of the Rules**, provisions of reduced air changes as per Note 3.a of **Table R19.1** may be correspondingly applied when the bilge pump is located directly inside a container cargo space. In such cases where several container cargo spaces are served by the same bilge pump, the bilge pump is to be installed in the container cargo space with the highest ventilation rate, compared to the other container cargo spaces.

4 With respect to the provisions of **19.3.5, Part R of the Rules**, bilge systems for cargo holds of open-top container ships are to be independent of the machinery space bilge system and be located outside of the machinery space.

R19.3.6 Personnel Protection

1 The full protective clothing specified in **19.3.6-1, Part R of the Rules** is for emergency purposes and consisting of a pair of gloves, boots, a protective clothing and helmet with goggles. When selecting the protective clothing the danger of the chemicals according to the class and liquid or gaseous state of intended cargoes is to be taken into account, referring to Appendix 1 of the *IMSBC* Code for solid bulk cargoes and emergency procedures (*EmS*) of the Supplement to the *IMDG* Code for packaged goods.

2 The spare bottles required in **19.3.6-2, Part R of the Rules** are to be in addition to the spare bottles required for fire-fighter's outfit.

R19.3.7 Portable Fire Extinguishers

1 With respect to the requirements of **19.3.7, Part R of the Rules**, Two portable fire extinguishers, each having a capacity of not less than 6 *kg* of dry powder or equivalent, are to be provided when dangerous goods are carried on the weather deck, in open ro-ro spaces and vehicle spaces, and in cargo spaces as appropriate. And, the type has to correspond to the Class *B* ones specified in note (2) of **Table R10.3.2-1**.

2 A portable carbon dioxide fire extinguisher having at least total capacity of 8.5 *kg* may be regarded as the equivalent portable fire extinguisher specified in **19.3.7, Part R of the Rules**.

R19.3.8 Insulation of Machinery Space Boundaries

1 With respect to the requirements specified in **19.3.8, Part R of the Rules**, the following requirements **(1)** to **(3)** are to be complied with:

(1) "*A*-60" class standard insulation is to be in accordance with the requirements specified in **R9.7.2**.

(2) In case that a closed or semi-closed cargo space in which dangerous goods are intended to carry is located partly above machinery spaces of category *A*, "*A*-60" class insulation is to be applied to the deck between these spaces. "*A*-60" class insulation is to be applied to a weather deck above machinery spaces of category *A*, where dangerous goods are intended to carry on the deck.

(3) In case where explosives except those included in compatibility group *S* of Division 1.4 in the *IMDG* Code are stowed, the goods are to be stowed 3 *m* horizontally away from the machinery space boundaries in accordance with the requirements of Note 3.b of **Table R19.3, Part R of the Rules**, and further, "*A*-60" class insulation is to be applied on the boundary. In case that the boundary is a bulkhead between the machinery space and the space intended for the carriage of dangerous goods in freight containers and portable tanks, "*A*-60" class insulation needs not apply to the bulkhead.

2 In case where dangerous goods are carried, no direct access is, in principle, to be provided between machinery spaces and cargo spaces. However, the access may be acceptable provided that air-lock space is provided between those doors. In this case, the following requirements **(1)** to **(5)** are to be complied with. This requirement does not apply to the ships carrying only dangerous goods which would not generate noxious gas (including in case of fire).

(1) One self-closing "*A*-60" class door and one self-closing steel door of reasonably gas-tight are to be provided.

(2) The self-closing steel doors of gas-tight are to be kept closed while the ship in service.

(3) The audible alarm device, showing whether the watertight door is closed or not, is to be provided near the door. This audible alarm device may work only when two doors open simultaneously.

(4) The indicator, showing whether the watertight door is open or closed, is to be provided in the bridge and near the door.

(5) Caution plates of "Don't keep open while the ship in service" and "Don't open two doors simultaneously" are to be provided near the door.

3 With respect to the requirements specified in **-2** above, such spaces as under deck passages in container carriers which comply with the following conditions need not be considered as cargo spaces.

(1) The spaces are separated from both of cargo spaces carrying dangerous goods and engine rooms by doors which are kept closed at sea and are provided with means of indication on the bridge showing whether these doors are open or closed; and

(2) The spaces are served by forced ventilation at least 6 *times* air changes per hour.

R19.3.9 Water Spray System

1 The wording "an approved fixed pressure water-spraying system" specified in **19.3.9, Part R of the Rules** means the system which complies with the requirements of **R27.2.3**.

2 The wording "other fixed fire-extinguishing system" specified in **19.3.9, Part R of the Rules** means the system which complies with the requirements of **R27.2.3**.

3 The wording "the suitable measures to limit the adverse effect upon stability of the added weight and free surface of water" required in **19.3.9, Part R of the Rules** means that the ship is to comply with the stability criteria specified in **2.2.1-1, Part U of the Rules** in any stage of accumulating water discharged from the fixed pressure water-spraying system in the cargo space. The initial condition of loading is to be in accordance with the provisions specified in **An2., Annex 1.1, Part 2-2, Part C of the Rules**.

R20 PROTECTION OF VEHICLE AND RO-RO SPACES

R20.2 General Requirements

R20.2.1 Application

With respect to the requirements of **20.2.1, Part R of the Rules**, for the electrical equipment in enclosed compartments adjoining enclosed cargo holds and having openings such as non gas-tight doors, hatches, scuttles and the like in their bulkheads and decks, the requirements in **20.3.2, Part R of the Rules** are generally to apply.

R20.3 Precaution against Ignition of Flammable Vapours in Closed Vehicle Spaces and Closed Ro-ro Spaces

R20.3.1 Ventilation Systems

1 With respect to the requirements of **20.3.1, Part R of the Rules**, the air ventilation of vehicle spaces and ro-ro spaces is to be of a exhaust type. However, in the following cases, the ventilation may be of a suction type:

(1) In case where there are no openings except those to exposed spaces.

(2) In case where machinery spaces of category *A* or accommodation spaces contiguous thereto are provided, and an air-locked corridor is available when access opening to the spaces is provided. A standard of air-locked corridor is shown in **Fig. R20.3.1-1**.

(3) In case where spaces other than those shown in **(2)** above are adjoining with the spaces and access opening thereto is provided, and an automatic closing door of reasonable gas-tightness is provided.

2 The wording "means to indicate any loss of the required ventilating capacity" specified in **20.3.1-3, Part R of the Rules** means, for instance, a no-voltage alarm of ventilating fans.

3 With respect to the requirements of **20.3.1-4, Part R of the Rules**, the ventilation system is to be provided with dampers capable of being closed by a single action or closing appliances capable of closing at equivalent speed.

4 "Permanent openings" specified in **20.3.1-5, Part R of the Rules** are to be so arranged to protect against the spread of the flame and smoke. For this purpose, the mentioned openings are to be arranged at the outside of the slanted area shown in **Fig. R20.3.1-2** in consideration of 2 *m* margin around the protected areas and under conditions of trim of up to 10 *degree* and heel or list of up to 20 *degrees* either way as a emergency condition.

5 With respect to the requirements of **20.3.1-4(1), Part R of the Rules**, at least one access route to the controls for closure of the ventilation system complying with the following **(1)** to **(3)** is to be provided. However, in cases where remote closing and position indicator arrangements from the bridge or a fire control station for those ventilator closures are provided, the following **(1)** to **(3)** are not required.

(1) The access routes are clearly marked and at least 600 *mm* clear width;

(2) The access routes are provided with a single handrail or wire rope lifeline not less than 10 *mm* in diameter, supported by stanchions not more than 10 *m* apart in way of any route which involves traversing a deck exposed to weather; and

(3) The access routes are fitted with appropriate means of access (such as ladders or steps) to the closing devices of ventilators located in high positions (i.e. 1.8 *m* or higher).

6 With regard to "air quality control system deemed appropriate by the Society" in **20.3.1-2(3), Part R of the Rules**, reference is made to *Appendix 1* of *"Revised Design Guidelines and Operational Recommendations for Ventilation Systems in Ro-Ro Cargo Spaces"* (*MSC.*1/*Circ.*1515).

Fig. R20.3.1-1

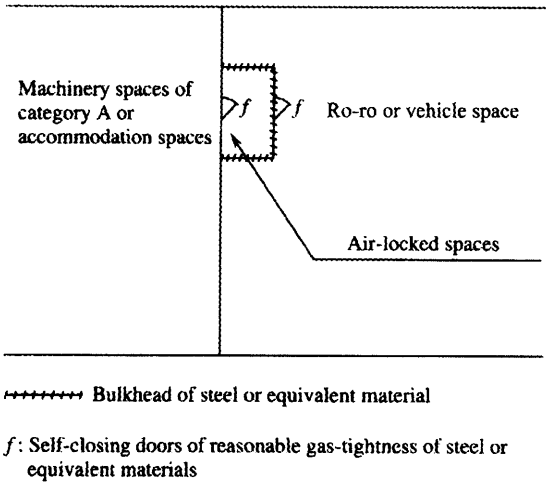
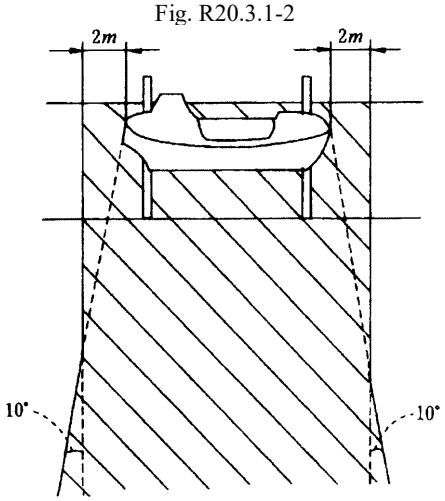


Fig. R20.3.1-2



R20.3.2 Electrical Equipment and Wiring

1 The wording "electrical equipment of a type suitable for use in explosive petrol and air mixture" in **20.3.2-1, Part R of the Rules** means those generally meeting the requirements in **2.16, Part H of the Rules**, having a construction suitable for use in Zone 1 as specified in *IEC* 60079-14:2013 certified as Apparatus Group II*A* and Temperature Class *T*3 or higher as specified in *IEC* 60079-10-1:2015 or Explosion Class *d*3 and Ignition Group *G*3 or higher as specified in the Recommended Practices for Explosion-Protected Electrical Installations in General Industries (NIIS-TR-NO.39 (2006)) issued by National Institute of Industrial Safety in Japan, or equivalent thereto. Further, cables complying with **4.2.4-5, Part H of the Rules** may generally be regarded as wiring of a type suitable for use in explosive petrol and air mixture.

2 The wording "electrical equipment of a type so enclosed and protected as to prevent the escape of sparks" in **20.3.2-2, Part R of the Rules** means the following **(1)** or **(2)**.

(1) The electrical equipment with a protection degree of at least *IP*55 as defined in **H2.1.3-4**.

(2) The electrical equipment suitable for use in the area of Zone 2 as specified in *IEC* 60079-14:2013 and with a temperature class of at least *T*3 as defined in *IEC* 60079-10-1:2015.

3 The wording "platforms with openings of sufficient size permitting penetration of petrol gases downwards" in **20.3.2-2, Part R of the Rules** means, for example, grating decks.

4 The wording "deck" in the provisions of **20.3.2-2, Part R of the Rules** excludes, for instance, grating decks with openings of sufficient size permitting penetration of petrol gases downwards.

R20.3.3 Electrical Equipment and Wiring in Exhaust Ventilation Ducts

The wording "a type approved for use in explosive petrol and air mixtures" in **20.3.3, Part R of the Rules** means that specified in **R20.3.2-1**.

R20.3.4 Other Ignition Sources

1 With respect to the requirements of **20.3.4, Part R of the Rules**, the windlass and opening for chain lockers are to be regarded as sources of ignition.

2 Exhaust fans except those ventilation fans which are of non-sparking type specified in **R4.5.4-1(2)**, unless protection screens of not more than 13 *mm* square mesh are to be fitted in the inlet and outlet ventilation openings of the ducts fitted with such fans on the open deck, are regarded as "facility which may become a source of ignition of flammable vapours" specified in **20.3.4-1, Part R of the Rules**.

3 As a rule, no portable electrical appliances are to be located in the cargo holds. Where it is unavoidable, they are subject to the approval of the Society.

R20.4 Detection and Alarm

R20.4.1 Fixed Fire Detection and Fire Alarm Systems

1 With respect to the provisions of **20.4.1, Part R of the Rules**, the requirement of the fire detection needs not apply to weather decks used for the carriage of vehicle.

2 The wording "an overall response time" specified in **20.4.1, Part R of the Rules** means an operating time specified in **R29.2.3-2**.

3 The detector sections in vehicle and ro-ro spaces may be provided with an arrangement, (e.g. a timer) for disconnecting detector sections during loading and unloading of vehicles to avoid "false" alarms. The time of disconnection is to be adapted to the time of loading/unloading. The central unit is to indicate whether the detector sections are disconnected or not. However, manual call points are not to be capable of being disconnected by the arrangements referred to above.

R20.4.3 Special category spaces

The wording "maintained by a continuous fire watch at all times" in **20.4.3-1, Part R of the Rules,** means either of the following **(1)** or **(2)**:

(1) a permanently and appropriately installed compartment from where designated personnel can effectively and continuously monitor the space; or

(2) means (e.g. video monitors) are provided in the engine control room or at the bridge for monitoring the space.

R20.5 Fire-extinction

R20.5.1 Fixed Fire-extinguishing Systems

1 With respect to the provisions of **20.5.1, Part R of the Rules**, the requirement of the fixed fire-extinguishing system needs not apply to weather decks used for the carriage of vehicle.

2 With respect to the requirements of **20.5.1, Part R of the Rules**, where container cargo holds fitted with partially weathertight hatch covers in accordance with the provisions of **14.6.7, Part 1, Part C of the Rules**, are intended for carriage of motor vehicles with fuel in their tanks for their own propulsion, such holds may be protected by a fixed carbon dioxide system, provided that the amount of carbon dioxide is increased in accordance with the provisions of **R25.2.2-5**.

3 The wording "other fixed fire-extinguishing system" specified in **20.5.1-3, Part R of the Rules** means a system complying with sections 1, 2, 3 and 5 of "*Revised Guidelines for the Design and Approval of Fixed Water-based Fire-fighting Systems for Ro-ro Spaces and Special Category Spaces*" (*MSC*.1/*Circ*.1430/Rev.3).

4 The "drainage systems" required by **20.5.1-4, Part R of the Rules** are to comply with the following **(1)** and **(2)**. However, in cases where the direct overboard discharge provisions or the bilge systems have a capacity sufficient for the additional flow from the fixed fire-extinguishing system and the required number of fire hoses, additional drainage facilities are not required.

(1) Arrangements above the bulkhead deck are to comply with the following **(a)** to **(d)**:

(a) an adequate number of properly-sized drains are to be provided on each deck to ensure that the combined water flow from

the fixed fire-extinguishing system and required number of fire hoses can be rapidly discharged overboard or drain to a bilge system with a reservoir tank fitted with a high water level alarm. "Drains" as used in this Chapter, refers to either scupper wells and scuppers, freeing ports, or bilge wells and drain pipes. However, freeing ports are not to be installed in enclosed the superstructures specified in **2.1.20, Part A of the Rules**.

(b) At least four drains are to be located on each side of a protected space, uniformly distributed fore and aft.

(c) The drainage system on each side of a deck is to have an aggregate capacity of not less than 125% of the maximum flow rate of the fixed fire-extinguishing system water pumps plus the flow from two fire hoses (four if required by **19.3.1-2, Part R of the Rules**). In cases where an automatic deep well or submersible pumping system is installed, the bilge pump capacity can be subtracted from the required drainage capacity.

(d) The minimum capacity of scuppers, freeing ports or a combination thereof are to be determined in accordance with the following **(i)** or **(ii)** respectively.

(i) The minimum required area of scuppers and connected piping is to be determined by the following formula. The area of each individual drain is not to be less than 0.0078 m^2 or 125 mm diameter piping:

$$A = \frac{Q}{0.5\sqrt{19.62(h - \sum h_l)}}$$

where

A: The total required sectional area of the drains on each side of the deck in (m^2);

Q: The combined waterflow from the fixed fire-extinguishing system and the required number of fire hoses in (m^3/s);

h: The elevation head difference between the bottom of the scupper well or suction level and the overboard discharge opening or highest approved load line in (m); and

$\sum h_l$: The summation of head losses corresponding to scupper piping, fittings and valves in (m).

(ii) The minimum required area of freeing ports is to be determined by the following formula. If the cross-sectional area of freeing ports required by **14.9.2, Part 1, Part C of the Rules** is equal to or greater than determined above, additional freeing ports are not required:

$$A = \frac{Q}{0.5\sqrt{19.62(h_1 - h_2)}}$$

where

A: The total required sectional area of freeing ports on each side of the ship (m^2);

Q: The combined waterflow from the fixed fire-extinguishing system and the required number of fire hoses (m^3/s); and

$h_1 - h_2$: The depth of water on each deck .This value is to be calculated by multiplying the maximum flow rate of the installed fire-extinguishing system water pumps plus the flow from two fire hoses (four if required by **19.3.1-2, Part R of the Rules**) by an operating time of 30 min. This volume of water is to be divided by the area of the affected deck (m).

(2) Arrangements below the bulkhead deck are to comply with the following **(a)** to **(f)**:

(a) An efficient bilge pumping system is to be provided to ensure that the combined water flow from the fixed fire-extinguishing system and the required number of fire hoses can be rapidly collected and led to suitable arrangements for discharge overboard. The bilge system capacity is to be not less than that required by following **(c)**.

(b) The bilge piping system is to be arranged in accordance with **13.5, Part D of the Rules**. At least four bilge wells are to be located on each side of a protected space, uniformly distributed fore and aft.

(c) The bilge pumping system on each side of the ship is to have an aggregate capacity of not less than 125% of the maximum flow rate of the fixed fire-extinguishing system water pumps plus the flow from two fire hoses (four, if required by **19.3.1-2, Part R of the Rules**).

(d) The required area of the main and branch bilge pipes for a protected space are to be adequate to ensure a waterflow of 2 m/s in each section of piping in accordance with the following **(i)** to **(iii)**:

(i) If the drainage system is a bilge pumping system, the following three criteria are to be satisfied:

$$\sum Q_{bpump} \geq 1.25Q$$

$$A_M \geq 0.625Q$$

$$\sum A_B \geq 0.625Q$$

where

$\sum Q_{bpump}$: The combined capacity of all power bilge pumps except the emergency bilge pump (m^3/s);

Q: The combined waterflow from the fixed fire-extinguishing system and the required number of fire hoses (m^3/s);

A_M: The sectional area of the main bilge pipe of the protected space (m^2)

$\sum A_B$: The total sectional area of branched bilge pipes for each side (m^2).

(ii) If the drainage system is based on gravity drains leading to a reservoir tank, the minimum required area of drains and connected piping are to be determined by **(1)(d)** above.

(iii) If the drainage system is a combined system, the relevant dimensioning for each part of the system is to be determined using **(i)** and **(ii)**.

(e) The required capacity of each bilge well is to be at least 0.15 m^3.

(f) If the system includes a reservoir tank, the tank is to have adequate capacity for at least 20 *min* of operation at the required drainage capacity for the affected space.

5 The wording "suitable measures to limit the adverse effect upon stability of the added weight and free surface of water" required in **20.5.1-4, Part R of the Rules** means that the ship is to comply with the stability criteria specified in **2.2.1-1, Part U of the Rules** in any stage of accumulating water discharged from the fixed pressure water-spraying system in the cargo space. The initial condition of loading is to be in accordance with the provisions specified in **An2., Annex 1.1, Part 2-2, Part C of the Rules**.

6 The wording "means to prevent the blockage of drainage arrangements" required in **20.5.1-5, Part R of the Rules** means that arrangements are to comply with the following **(1)** to **(3)**:

(1) An easily removable grating, screen or other means is to be installed over each drain opening in protected spaces to prevent debris from blocking the drain. The total open area ratio of the grating to the attached drain pipe is to be at least 6 to 1. The grating is to be raised above the deck or installed at an angle to prevent large objects from blocking the drain. No dimensions of individual openings in the grating are to be more than 25 *mm*.

(2) No grating or screen is required in cases where a fixed mechanical system is provided to unblock the drainage system or in cases where the drainage system, excluding a gravity drain system, is provided with its own filter.

(3) A clearly visible sign or marking are to be provided not less than 1,500 *mm* above each drain opening stating, "Drain opening – do not cover or obstruct". The marking are to be at least 50 *mm* in height.

7 In lieu of the above **-4** and **-6**, the Administration, after having given consideration to ship arrangement and equipment, may accept other fixed installations if they afford equivalent protection. Any equivalent protection is to demonstrate the capability to rapidly drain fire-fighting water from affected decks and prevent the build-up of free surfaces under expected conditions of trim and list, for as long as the fire-extinguishing system is in operation.

R20.5.2 Portable Fire Extinguishers

1 With respect to the requirements of **20.5.2-1, Part R of the Rules**, portable extinguishers need not be provided at ro-ro spaces etc. on weather decks, except the one positioned at each entrance to the spaces. Portable foam applicators also need not to be provided on weather decks.

2 With respect to the requirements of **20.5.2, Part R of the Rules**, cargo holds, loaded with vehicles with fuel in their tanks and stowed in open or closed containers need not to be provided with the portable extinguishers, water-fog applicators and foam applicator unit.

3 With respect to the requirements given in **20.5.2, Part R of the Rules**, the type of portable fire extinguisher has to correspond to the Class *B* ones specified in note (2) of **Table R10.3.2-1**.

4 The "water fog applicators deemed as appropriate by the Society" specified in **20.5.2-2(1)** means ones that have passed inspections by organisations authorised by the Administration or that are otherwise deemed appropriate by the Society.

5 In the count of at least two portable foam applicator units required in **20.5.2-2(2), Part R of the Rules**, the portable foam applicator units provided under other requirements may be included.

R20A REQUIREMENTS FOR VEHICLE CARRIERS FOR CARRIAGE OF MOTOR VEHICLES WITH COMPRESSED HYDROGEN OR COMPRESSED NATURAL GAS IN THEIR TANKS FOR THEIR OWN PROPULSION AS CARGO

R20A.3 Requirements for Spaces Intended for Carriage of Motor Vehicles with Compressed Natural Gas in their Tanks for their own Propulsion as Cargo

R20A.3.1 Electrical Equipment and Wiring

The wording "certified safe type for use in an explosive methane and air mixture" in **20A.3.1, Part R of the Rules** means those having a construction suitable for use in Zone 1 as specified in *IEC* 60079-14:2013 certified as Apparatus Group II*A* and Temperature Class *T*1 or higher as specified in *IEC* Publication 60079 or Explosion Class *d*1 and Ignition Group *G*1 or higher as specified in the Recommended Practices for Explosion-Protected Electrical Installations in General Industries (NIIS-TR-NO.39 (2006)) issued by National Institute of Industrial Safety in Japan, or equivalent thereto. Further, cables which comply with the requirements in **4.2.4-5, Part H of the Rules** may be regarded as a "certified safe type for use in an explosive methane and air mixture".

R20A.3.2 Ventilation Arrangement

1 Electrical equipment and wiring of a "certified safe type for use in explosive methane and air mixtures" in **20A.3.2-1, Part R of the Rules** are to be in accordance with **R20A.3.1**.

2 The fans "such as to avoid the possibility of ignition of methane and air mixtures" in **20A.3.2-2, Part R of the Rules** mean fans which comply with the requirements in **R4.5.4-1(2)**. For the purpose of this requirement, wire mesh guards with meshes not exceeding 13 *mm* × 13 *mm* are to be fitted over the ventilation openings above the open deck of the ducts in which such fans are fitted.

R20A.4 Requirements for Spaces Intended for Carriage of Motor Vehicles with Compressed Hydrogen in their tanks for their own Propulsion as Cargo

R20A.4.1 Electrical Equipment and Wiring

The wording "certified safe type for use in an explosive hydrogen and air mixture" in **20A.4.1, Part R of the Rules** means those having a construction suitable for use in Zone 1 as specified in *IEC* 60079-14:2013 certified as Apparatus Group II*C* and Temperature Class *T*1 or higher as specified in *IEC* Publication 60079 or Explosion Class *d*3 and Ignition Group *G*1 or higher as specified in Recommended Practices for Explosion-Protected Electrical Installations in General Industries (NIIS-TR-NO.39 (2006)) issued by National Institute of Industrial Safety in Japan, or equivalent thereto. Further, cables which comply with the requirements in **4.2.4-5, Part H of the Rules** may be regarded as a "certified safe type for use in an explosive hydrogen and air mixture".

R20A.4.2 Ventilation Arrangement

1 Electrical equipment and wiring of a "certified safe type for use in explosive hydrogen and air mixtures" in **20A.4.2-1, Part R of the Rules** are to be in accordance with **R20A.4.1**.

2 The fans "such as to avoid the possibility of ignition of hydrogen and air mixtures" in **20A.4.2-2, Part R of the Rules** mean fans which comply with the requirements in **R4.5.4-1(2)**. For the purpose of this requirement, wire mesh guards with meshes not exceeding 13 *mm* × 13 *mm* are to be fitted over the ventilation openings above the open deck of the ducts in which such fans are fitted.

R20A.5 Detection

R20A.5.1 Portable Gas Detectors

Portable gas detectors of a "certified safe type for use in the explosive gas and air mixture" in **20A.5.1, Part R of the Rules** are to be in accordance with **R20A.3.1** and/or **R20A.4.1**.

R21 SPECIAL REQUIREMENTS FOR SMALL SHIPS AND SHIPS FOR RESTRICTED SERVICE

R21.2 Special Requirements

R21.2.1 Requirements for Ships of less than 500 *Gross Tonnage*

1 With respect to the provisions of **21.2.1, Part R of the Rules**, the following **-2** to **-13** may apply to ships of less than 500 *gross tonnage*.

2 The following **(1)** to **(3)** requirements relating to fire protection may be applied in lieu of the provisions of **4.4.3**, **4.4.4**, **4.5.1** (except **-8**), **4.5.2**, **5.3**, **6.2**, **6.3**, **8.2.1**, **8.4.1**, **Chapter 9** (except **9.5.2** and **9.6**), **11.2**, **11.3.1(2)**, **11.4**, **20.3.1** and **20.3.5, Part R of the Rules**.

(1) Boundary walls of machinery spaces of category *A* (including doors) and the floor plating of normal passageways in such machinery spaces are to be of steel or other equivalent material. The doors in such boundary walls are to be of self-closing type.

(2) In ships provided with vehicle spaces including ro-ro spaces intended for carriage of motor vehicles with fuel in their tanks for their own propulsion, the following requirements are to be complied with.

(a) The bulkheads and decks which consist of the boundaries of such spaces, machinery spaces and galleys are to be of the divisions specified in **Tables R9.1** and **R9.2, Part R of the Rules** corresponding to adjacent spaces.

(b) The requirements specified in **4.4.3, Part R of the Rules** are to apply to the boundaries of such spaces, machinery spaces and galleys.

(c) In case where equivalent fire integrity as in "*A*" class divisions is required for shell plating and other walls in accordance with the provisions of **(a)** above, no windows nor side scuttles are to be provided therein.

(d) The requirements specified in **9.3.1**, **9.3.3**, **9.4.1** and **9.4.2, Part R of the Rules** are to apply to the boundaries required to have fire integrity in accordance with the provisions of **(a)** above.

(3) In ships provided with closed vehicle spaces including closed ro-ro spaces intended for carriage of motor vehicles with fuel in their tanks for their own propulsion, the requirements of **20.3.1** (excluding **-3**), **Part R of the Rules** are to apply in addition to **(2)** above.

3 Notwithstanding the provisions of **4.2.2(3)(e)i)1), Part R of the Rules**, an additional oil-level gauge may be omitted.

4 The requirements of **4.2.2(5)(b), Part R of the Rules** relating to the protection of high-pressure oil fuel piping may not apply to diesel engines having a maximum continuous output of less than 375 *kW*, and installed in the space other than machinery spaces of category *A*, provided that a suitable enclosure for the fuel injection piping system on such a engine is fitted.

5 The requirements of **4.2.2(5)(e), Part R of the Rules** relating to the means of isolating the fuel supply and spill piping to individual engines may not apply to such ships.

6 The requirements of **4.2.2(8), Part R of the Rules** relating to the pre-treatment equipment for flammable liquid may not apply to such ships.

7 The requirements of **4.5.3-2(3)** and **11.6.3-2, Part R of the Rules** relating to the secondary means for pressure/vacuum relief may not apply to such ships.

8 With respect to the provisions of **4.5.3-3, Part R of the Rules**, suitable wire gauze complying with the requirements in **7.4.2-2(3)(a)i)** through **ix)** and **(b)**, **Part 6 of GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE** and those in **D14.3.2-3(1)** may be substituted for the flame screen or flame arrester to be fitted at the openings specified in **R4.5.3-3(2)(a)**; and a flame screen or such wire gauze may be substituted for the flame arrester to be fitted at the openings specified in **R4.5.3-3(2)(b)**. Flame arresters required for openings specified in **R4.5.3-3(2)** may be of a type for which an endurance burning test is dispensed with. High velocity devices required for outlets specified in **R4.5.3-3(2)(b)** and **(c)** may be of a type for which a flash back test and an endurance burning test are dispensed with.

9 Notwithstanding the provisions of **10.2.2-2, Part R of the Rules**, ships of less than 150 *gross tonnage* may dispense with the independent fire pump, provided that one power pump is available as a main fire pump.

10 The requirements specified in **10.2.2-3(2)** to **(5)** and **10.4.3(7), Part R of the Rules** may not apply.

11 Notwithstanding the provisions of **10.8** and **10.9, Part R of the Rules**, the fire extinguishing arrangements for tankers may be to the satisfaction of the Society.

12 The requirements of **10.7.2, Part R of the Rules** need not apply to.

13 The requirements of **13.3.3** and **13.4.7, Part R of the Rules** relating to emergency escape breathing devices may not apply.

R21.2.2 Requirements for Ships Not Engaged On International Voyages

1 With respect to the provisions of **21.2.2, Part R of the Rules**, the following **-2** to **-9** may apply to ships not engaged on international voyages.

2 Notwithstanding the provisions of **4.2.2(3)(e)i)1), Part R of the Rules**, an additional oil-level gauge may be omitted.

3 The requirements of **4.2.2(5)(b), Part R of the Rules** relating to the protection of high-pressure oil fuel piping may not apply to diesel engines having a maximum continuous output of less than 375 *kW*, and installed in the space other than machinery spaces of category *A*, provided that a suitable enclosure for the fuel injection piping system on such a engine is fitted.

4 With respect to the provisions of **4.5.3-3, Part R of the Rules**, the devices to prevent the passage of flame may be of a type in accordance with the followings.

(1) Flame arresters required for openings specified in **R4.5.3-3(2)** may be of a type for which an endurance burning test is dispensed with.

(2) High velocity devices required for outlets specified in **R4.5.3-3(2)(b)** and **(c)** may be of a type for which a flash back test and an endurance burning test are dispensed with.

5 Notwithstanding the provisions of **10.2.1-7(1), Part R of the Rules**, the international shore connection need not be provided.

6 Notwithstanding the provisions of **10.3.3-1, Part R of the Rules**, the spare charges may be provided for 10% of the total fire extinguishers required in **Part R of the Rules**.

7 Notwithstanding the provisions of **15.2.2, Part R of the Rules**, the exhibition and the storage of the fire control plans and a booklet may be dispensed with.

8 Notwithstanding the provisions of **14.2.2-2** and **16.2.1-1, Part R of the Rules**, the contents of the fire safety operational booklets and the maintenance plan may be limited to those for installations other than the following equipment:

(1) automatic sprinkler systems;

(2) fixed inert gas systems; and

(3) fire detection and fire alarm systems.

9 The provisions of **R21.2.1** may apply to ships of less than 500 *gross tonnage*.

R21.2.3 Requirements for Ships for Restricted Service

With respect to the provisions of **21.2.3, Part R of the Rules**, the provisions of **R21.2.1-2** may apply to ships for restricted service and not engaged on international voyages, provided that **R21.2.1-5**, **-11** and **-12** may apply to ships of less than 500 *gross tonnage* only.

R21.2.4 Requirements for Fishing Vessels

With respect to the provisions of **21.2.4, Part R of the Rules**, the provisions of **R21.2.1-1** may apply to fishing vessels.

R21.2.5 Requirements for Other Ships

With respect to the provisions of **21.2.5, Part R of the Rules**, the provisions of **R21.2.1-1** may apply to vessels not propelled by mechanical means, such as barges. In addition, the extent and degree of application of the relevant requirements of **Chapters 4** to **16, Part R of the Rules** may be modified to a reasonable extent depending on the construction, purpose, etc. of the vessels. These requirements may not apply to unmanned barges.

R23 PERSONNEL PROTECTION

R23.2 Engineering Specifications

R23.2.1 Fire-fighter's Outfit

1 The personal equipment specified in **(1)** to **(4)** of **23.2.1-1**, the breathing apparatus specified in **23.2.1-2** and the lifeline specified in **23.2.1-3, Part R of the Rules** are to pass the inspection of organizations authorized by the Administration or deemed appropriate by the Society.

2 With respect to the wording "explosion-proof type" specified in **23.2.1-1(4), Part R of the Rules**, reference is made to *IEC* 60079, *Electrical Apparatus for Explosive Gas Atmospheres*.

3 The axe specified in **23.2.1-1(5), Part R of the Rules**, is to comply with standards authorized by the Administration or deemed appropriate by the Society.

4 Fire-fighter's outfits for chemical tankers and gas carriers are to be subject to the Society's special consideration in each case.

5 With respect to the requirements of **23.2.1-2(2), Part R of the Rules**, a pressure indicator, with which the user can read that the volume of remaining air in the cylinder has been reduced to no less than 200 *l*, regardless of the need for supplemental lighting, may be regarded as a "visual device".

R23.2.2 Emergency Escape Breathing Device (*EEBD*)

The wording "an approved type" specified in **23.2.2-1, Part R of the Rules** means a type which has passed the inspection of organizations authorized by the Administration or deemed appropriate by the Society in accordance with the "*Guidelines for the Performance, Location, Use and Care of Emergency Escape Breathing Devices*" (*MSC/Circ.*849).

R24 FIRE EXTINGUISHERS

R24.1 General

R24.1.2 Type Approval

The wording "fire extinguishers of approved types and designs" specified in **24.1.2, Part R of the Rules** means those which have passed the inspection of organizations authorized by Administration or deemed appropriate by the Society with reference made to the "*Improved guidelines for marine portable fire extinguishers*" (*IMO Res. A.*951(23)) or other standards accepted by the Administration.

R24.2 Engineering Specifications

R24.2.1 Fire Extinguisher

1 The "equivalents" of fire extinguishers specified in **24.2.1-1, Part R of the Rules** are to be as the following **(1)** or **(2)**.

(1) Powder and carbon dioxide gas fire extinguishers with a mass of not more than 9.5 *kg*.

(2) Liquid fire extinguishers of not more than 13.5 *litres*.

2 With respect to the requirements of **24.2.1-2, Part R of the Rules**, the approved refills are to be as the provisions of **R24.1.2**.

R24.2.2 Portable Foam Applicators

"Approved foam concentrates" specified in **24.2.2-2(2), Part R of the Rules** means concentrates that have been approved by organizations authorized by the Administration or deemed appropriate by the Society with reference to the "*Revised guidelines for the performance and testing criteria, and surveys of foam concentrates for fixed fire-extinguishing systems*" (*MSC.*1/*Circ.*1312).

R25 FIXED GAS FIRE-EXTINGUISHING SYSTEMS

R25.1 General

R25.1.1 Application

1 The requirements in **Chapter 25, Part R of the Rules** for a fixed gas fire-extinguishing system in cargo spaces or machinery spaces may not apply to local fixed extinguishers dedicated to paint lockers, exhaust ducts from galley ranges and spaces where pretreatment equipment for flammable liquid such as purifiers, oil heaters, etc. are placed.

2 Except for those items specified in this Guidance, general items related to equipment and system are to comply with the requirements given in **Chapter 1**, vessels with **Chapter 10**, welding with **Chapter 11**, piping systems with **Chapters 12** and **Chapters 13**, and refrigerating plants with **Chapter 17 of Part D of the Rules** respectively.

R25.2 Engineering Specifications

R25.2.1 General Requirements

1 The wording "spare parts to the satisfaction of the Society" specified in **25.2.1-2(3), Part R of the Rules** means the spare parts recommended by system manufacturers. However, in cases where manufacturers do not recommend any spare parts, such parts are, in principle, considered to be rupture seals (including those for starting and the packing) for all containers, rupture discs (including those for starting and the packing) for 1/3 of all containers, packing and O-rings intended for recharging 1/10 of all containers, and the tools needed for system maintenance purposes.

2 The wording "air testing that is required by the Society" specified in **25.2.1-2(6), Part R of the Rules** means the test specified in **2.1.7, Part B of the Rules**.

3 The alarm system required in **25.2.1-3(2), Part R of the Rules** is to comply with the following requirements.

(1) The alarm system is to be so arranged that the failure of the other alarm or call system will not affect its performance.

(2) The alarm is to be easily distinguished from any other audible alarm or call.

4 The "means of control of any fixed gas fire-extinguishing system" specified in **25.2.1-3(3), Part R of the Rules** is not to be provided in spaces distant from normally manned spaces. In ships having their accommodation spaces at the stern where such means of control is provided in the bow or deck house above cargo hold due to an unavoidable reason, a remote control either from the navigation bridge or the fire control stations is to be made available in addition to the manual local control.

5 The "means of control of any fixed gas fire-extinguishing system" specified in **25.2.1-3(3), Part R of the Rules** is, in principle, to be provided at a control station such as the fire control station. It is recommended also that other fire control systems are to be centralized at the same location as far as practicable.

6 With respect to the provisions of **25.2.1-3(3), Part R of the Rules**, fire-extinguishing media protecting the cargo holds may be stored in a room located forward the cargo holds, but aft of the collision bulkhead, provided that both the local manual release mechanism and remote control(s) for the release of the media (including control valves for the release of different quantities of the media into different cargo holds) are fitted, and the latter is of robust construction or so protected as to remain operable in case of fire in the protected spaces. The remote controls are to be placed in the accommodation area such as the navigation bridge, the fire control station, etc., in order to facilitate their ready accessibility by the crew.

7 The wording "conventional cargo spaces" specified in **25.2.1-3(2), Part R of the Rules** means cargo spaces other than ro-ro spaces or container holds equipped with integral reefer containers.

R25.2.2 Carbon Dioxide Systems

1 For the carbon dioxide system specified in **25.2.2, Part R of the Rules**, the following requirements **(1)** to **(3)** are to be complied with:

(1) The pipe size and diameter of nozzle orifice are, except where pressure loss calculation is carried out for individual determination, to be in accordance with the following standards. Additionally, the arrangement is to be such that the carbon dioxide flows in a liquid state up to the nozzle and the pressure at the nozzle is 1 *MPa* or more.

(a) In machinery spaces of category *A*, pump rooms in oil tankers, and ro-ro spaces, etc., the size of the main is to be determined by **Table R25.2.2-1** according to the carbon dioxide gas supply.

The total area of orifice is not to exceed the smaller of the 85% value obtained by multiplying 0.0313 by the specified quantity (*kg*) or the cross sectional inside area (cm^2) of the main by **Table R25.2.2-1**, but not to be below the 40% value.

(2) Arrangements of nozzles in cargo spaces (excluding ro-ro spaces) are to be, in general, as follows:

(a) In ships having tween deck cargo spaces, arrangements are to be such that carbon dioxide gas is discharged separately for the lower cargo hold and the upper cargo hold respectively.

(b) The discharge distribution of carbon dioxide gas on the ceiling of the protected spaces is to be adequate.

(3) The number, type and arrangements of nozzles of carbon dioxide gas in machinery spaces of category *A*, pump rooms in oil tankers, ro-ro spaces, etc. are to be such that the gas is discharged at uniform rate in each space.

Table R25.2.2-1 Carbon Dioxide Gas Supply and Pipe Size

Carbon dioxide gas supply (*kg*)		Pipe size	
Ro-ro spaces, etc.	Machinery spaces of category *A*, pump rooms of oil tanker		
Under 290	Under 45.5	1/2*B*	15*A*
290 and under 580	45.5 and under 91	3/4	20
580 and under 867	91 and under 136	1	25
867 and under 1,485	136 and under 233	1 1/4	32
1,485 and under 2,142	233 and under 336	1 1/2	40
2,142 and under 4,016	336 and under 630	2	50
4,016 and under 7,650	630 and under 1,200	2 1/2	65
7,650 and under 13,069	1,200 and under 2,050	3	80
13,069 and under 20,400	2,050 and under 3,200	3 1/2	90
20,400 and under 30,218	3,200 and under 4,740	4	100
30,218 and under 58,459	4,740 and under 9,170	5	125
58,459 and under 91,991	9,170 and under 14,430	6	150

Note:

The wording “ro-ro spaces, etc.” means the ro-ro spaces or vehicle spaces.

2 For the bulkheads or decks forming the boundaries of the storage room of fire-extinguishing medium for the system required in **25.2.2, Part R of the Rules**, consideration is to be given so as not to permit the internal temperature rises above the maximum design service temperature. The maximum design service temperature of a low pressure gas vessel is 45°C.

3 The requirements specified in **25.2.2-2, Part R of the Rules** apply to the spaces identified in **25.2.1-3(2), Part R of the Rules**. The means of gas control of the fixed gas fire-extinguishing system is to comply with the following requirements:

(1) In case where the same gas container is used for individual separate spaces, the control valve (normally closed) is to be fitted to each gas discharge main led to each space respectively.

(2) In case where discharge of carbon dioxide gas is remotely controlled, manual means of control is to be provided at the storage position of gas containers.

(3) Where carbon dioxide gas is discharged by the gas pressure of the starting gas container (including the carbon dioxide gas container itself), two or more containers are to be provided and a local manual means of opening the containers is to be provided.

(4) Where automatic discharge regulator of carbon dioxide gas for the protected spaces is provided, a manual regulator is to be provided.

(5) If the system serves more than one spaces, means for control of discharge quantities of carbon dioxide are to be provided, *e.g.* automatic timer or accurate level indicators located at the control position.

(6) At the operating station of carbon dioxide system, an instruction manual is to be placed.

(7) The wording “Positive means” specified in **25.2.2-2(1), Part R of the Rules** means mechanical and/or electrical interlocks that do not depend on any operational procedures.

(8) The "two separate controls" specified in **25.2.2-2(1), Part R of the Rules** can be independent of the controls for activating pre-discharge alarms.

(9) A single control for the activating the "alarm" specified in **25.2.2-2(1), Part R of the Rules** is sufficient.

4 The low pressure vessels of the carbon dioxide gas for fire-extinguishing and their associated equipment specified in **25.2.2-3, Part R of the Rules** are to comply with the following requirements:

(1) Vessels are to be classified into Pressure Vessels, Group I (*PV*-1). The design pressure of the vessels is not to be less than the set pressure of the pressure relief valves. The welding of manhole rings and pipe nozzles to the shell of the vessel is to be of the full penetration type.

(2) The capacity of each pressure relief valve may be calculated in accordance with the following formula:

$$W = \frac{9400\lambda(650-t)A^{0.82}}{\sigma L} + \frac{H}{L}$$

W: Total relieving capacity per hour (kg/h)

A: External surface area of the vessel (m^2)

t: Temperature of CO_2 at relieving conditions, i.e. the pressure at which the pressure valve is set. (℃)

L: Latent heat of CO_2 being vapourized at relieving conditions (J/kg)

λ: Heat conductivity of insulation material under normal working temperature ($Watt/m \cdot K$)

σ: Thickness of the heat insulating material (m)

H: Correction factor for other heat sources

H = Quantity of heat input ($J/m^2 \cdot h$) $\times a$

a: exposed area for heat source (m^2)

(3) The high pressure alarm, the low pressure alarm and the low level alarm specified in **25.2.2-3, Part R of the Rules** are to be audible and visible at the navigation bridge and at the places where such alarms can be confirmed by the engineer on duty.

(4) The insulating materials and their lines are to be to the satisfaction of the Society, having in mind, in particular their self-extinguishing property and mechanical properties, as well as protection against penetration of water vapours.

(5) The design pressures of pipes, valves and fittings provided between the vessel and the distribution manifold are not to be less than the design pressure of the vessel. The design pressures of pipes and fittings provided in the downstream of the distribution manifold are not to be less than the maximum working pressure of the fluid in the pipe and be not less than 1.0 *MPa*.

(6) In the event of failure of either one of the refrigerating units the other is to be actuated automatically. In this case, audible and visible alarms are to be annunciated at the navigating bridge and the places where the alarms can be confirmed by the engineer officer on duty.

(7) Provision is to be made for local manual control of the refrigerating plant.

(8) The supporting legs of the vessels are to be installed on the seating by way of suitable thermal insulation.

5 With respect to the provisions of **25.2.2-1(1), Part R of the Rules**, for container cargo holds fitted with partially weathertight hatch covers in accordance with the provisions of **14.6.7, Part 1, Part C of the Rules**, the quantity of carbon dioxide is not to be less than the following values.

(1) The sum of the quantity specified in **25.2.2-1(1), Part R of the Rules** and the value W_1 obtained by the following formula.

$$W_1 = 60A_T\sqrt{\frac{B_C}{2}} \ (kg)$$

A_T: Total area of clear gaps between hatch cover panels (m^2)

B_C: Breadth of the cargo holds (m)

(2) For container cargo holds intended for carriage of motor vehicles with fuel in their tanks for their own propulsion, the value given by the followings, whichever is greater.

(a) The value given in **(1)** above.

(b) The sum of the quantity specified in **20.5.1-1(1), Part R of the Rules** and the value W_2 obtained by the following formula.

$$W_2 = 4A_T\sqrt{\frac{B_C}{2}} \ (kg)$$

A_T and B_C: As specified in **(1)**

6 The discharge time specified in **25.2.2-1(2), (6)** and **(8), Part R of the Rules** may be checked by suitable calculations.

7 The wording "quantity of gas" specified in **25.2.2-1(8), Part R of the Rules** means that quantity required for the largest cargo space.

R25.2.4 Equivalent Fixed Gas Fire-extinguishing Systems for Machinery Spaces and Cargo Pump Rooms

1 An equivalent system specified in **25.2.4, Part R of the Rules** is to be in accordance with any of the following Guidelines.

(1) "*Approval of Equivalent Fixed Gas Fire-extinguishing Systems, as referred to in SOLAS 74, for machinery spaces and cargo pump rooms* (*MSC/Circ.*848)" (including amendments made by *MSC.*1/*Circ.*1267).

(2) "*Revised Guidelines for the Approval of Fixed Aerosol Fire-Extinguishing Systems Equivalent to Fixed Gas Fire-Extinguishing Systems, as referred to in SOLAS 74, for machinery spaces*" (*MSC.*1/*Circ.*1270).

2 Fixed gas fire-extinguishing systems referred to in **-1(1)**, whose agent containers are stored within the area it protects are to comply with the following **(1)** to **(3)**.

(1) Agent containers are to be distributed throughout the space with bottles or groups of bottles located in at least six separate locations.

(2) Duplicate power release lines are to be arranged to release all bottles simultaneously. The release lines are to be so arranged that in the event of damage to any power release line, five sixths of the fire extinguishing gas can still be discharged. The bottle valves are to be considered to be part of the release lines and a single failure shall include also failure of the bottle valve.

(3) For systems that need less than six cylinders (using the smallest bottles available), agent containers need not to be distributed separately, provided that:

(a) The total amount of extinguishing gas in the bottles is to be such that in the event of a single failure in one of the release lines (including bottle valve), five sixths of the fire extinguishing gas can still be discharged; and

(b) *NOAEL* (*No Observed Adverse Effects Level*) values calculated at the highest expected engine room temperature are not to be exceeded when discharging the total amount of extinguishing gas simultaneously.

R26 FIXED FOAM FIRE-EXTINGUISHING SYSTEMS

R26.3 Fixed High-expansion Foam Fire-extinguishing Systems

R26.3.1 Principal Performance

1 The wording "approved foam concentrates" specified in **26.3.1-2, Part R of the Rules** means those approved by organizations authorized by the Administration or deemed appropriate by the Society with reference to the "*Guidance for Performance and Testing Criteria and Surveys of High Expansion Foam Concentrates for Fire-extinguishing Systems*" (*MSC/Circ.*670).

2 The foam generators required in **26.3.1-5, Part R of the Rules** are, in principle, to be driven by an independent power source. In cases where this source of power is internal combustion machinery, it is to be of a compression ignition type.

3 The means of remote control specified in **26.3.3-1(5)** and **26.3.3-2(6), Part R of the Rules** are also to be manually operated.

4 The wording "standards to the satisfaction of the Society" specified in **26.3.1-3, Part R of the Rules** means the "*Guidelines for the Testing and Approval of Fixed High-expansion Foam Systems*" (*MSC.*1/*Circ.*1384).

5 Where the Hazen-Williams method is used as the "hydraulic calculation technique" specified in **26.3.1-13, Part R of the Rules**, the friction factors used are to be the values specified in **Table R26.3.1-1**.

Table R26.3.1-1

Pipe type	friction factor *C*
Black or galvanized mild steel	100
Copper or copper alloys	150
Stainless steel	150

R26.3.2 Inside Air Foam Systems

1 With respect to the requirements of **26.3.2-1(2), Part R of the Rules**, where a machinery space of category *A* includes a casing, the volume of the largest protected space is to include that of the machinery space up to the following **(1)** or **(2),** whichever is higher: (See **Fig. R26.3.2-1**)

(1) the lowest part of the casing; or

(2) 1 *m* above the highest point of the highest positioned fire risk objects within the machinery space. Such fire risk objects include those listed in **3.2.31, Part R of the Rules**, and those defined in **3.2.34, Part R of the Rules** as well as those having a similar fire risk such as exhaust gas boilers or oil fuel tanks.

2 With respect to the requirements of **26.3.2-1(2), Part R of the Rules**, where a machinery space of category *A* does not include a casing, the volume of the largest protected space is to be that of the space in its entirety, irrespective of the location of any fire risk object therein. (See **Fig. R26.3.2-2**)

R26.3.3 Outside Air Foam Systems

1 With respect to the requirements of **26.3.3-1(2), Part R of the Rules**, where a machinery space of category *A* includes a casing, the volume of the largest protected space is to include that of the machinery space up to the following **(1)** or **(2),** whichever is higher: (See **Fig. R26.3.2-1**)

(1) the lowest part of the casing; or

(2) 1 *m* above the highest point of the highest positioned fire risk objects within the machinery space. Such fire risk objects include those listed in **3.2.31, Part R of the Rules**, and those defined in **3.2.34, Part R of the Rules** as well as those having a similar fire risk such as exhaust gas boilers or oil fuel tanks.

2 With respect to the requirements of **26.3.3-1(2), Part R of the Rules**, where a machinery space of category *A* does not include a casing, the volume of the largest protected space is to be that of the space in its entirety, irrespective of the location of any fire risk object therein. (See **Fig. R26.3.2-2**)

Fig. R26.3.2-1 The Largest Protected Space within a Machinery Space of Category *A* Including a Casing

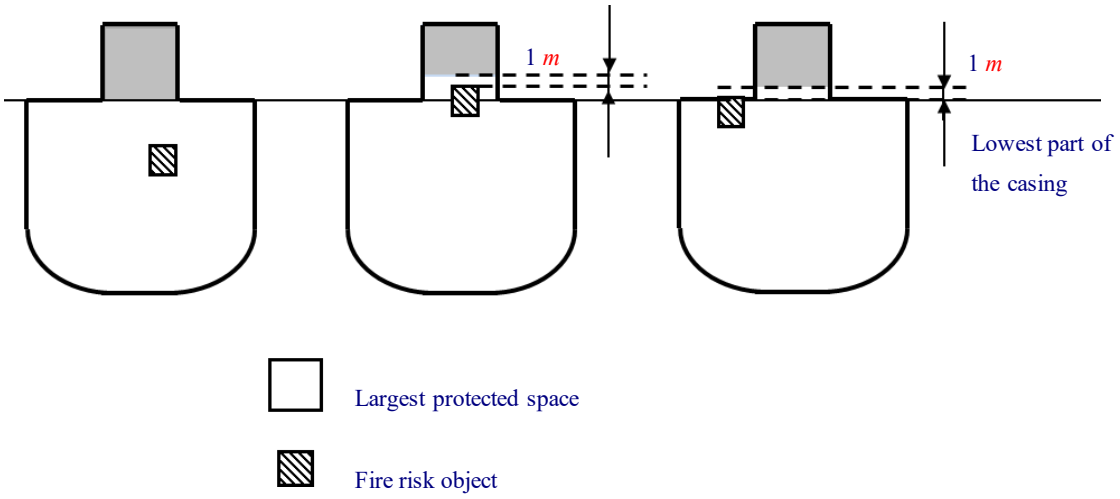
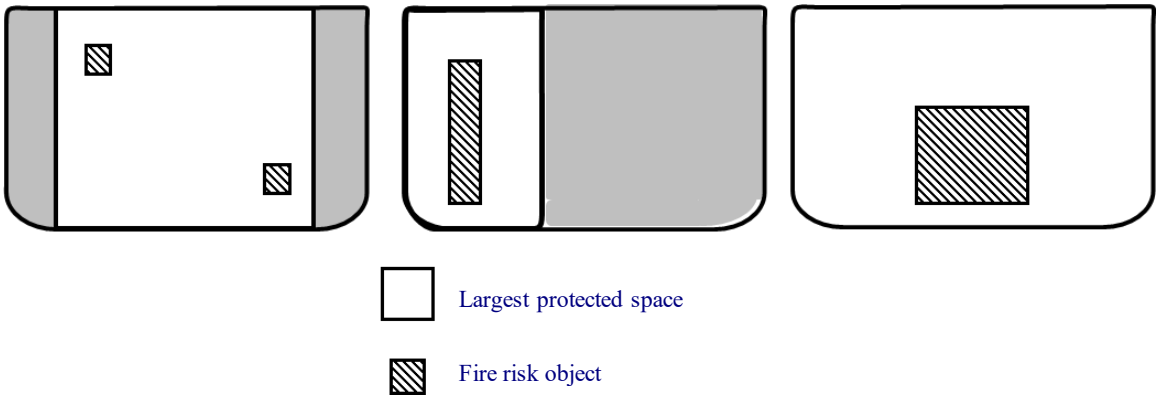


Fig. R26.3.2-2 The Largest Protected Space within a Machinery Space of Category *A* Not Including a Casing



R26.4 Fixed Low-expansion Foam Fire-extinguishing Systems

R26.4.1 Quantity and Foam Concentrates

1 The wording "approved foam concentrates" specified in **26.4.1-1, Part R of the Rules** means those approved by organizations authorized by the Administration or deemed appropriate by the Society with reference to the "*Revised Guidelines for the Performance and Testing Criteria, and Surveys of Foam Concentrates for Fixed Fire-extinguishing Systems*" (*MSC*.1/*Circ*.1312).

2 The wording "largest single area over which oil fuel is liable to spread" specified in **26.4.1-2, Part R of the Rules** means as follows:

(1) The aggregate total floor area of the tank top or floor top in machinery spaces and pump rooms in oil tankers.

(2) In spaces containing oil-fired boilers and oil fuel units where a suitable coaming capable of preventing undue spread of fuel oil is provided, the area of the space enveloped by such coaming. In this case, the coaming height is to be sufficient against a list of 15 degrees and a trim of 10 degrees of the ship. However, in no case it is necessary to exceed 750 *mm*.

R27 FIXED PRESSURE WATER-SPRAYING AND WATER-MIST FIRE-EXTINGUISHING SYSTEMS

R27.2 Engineering Specifications

R27.2.1 Fixed Pressure Water-spraying Fire-extinguishing Systems

"Approved system" specified in **27.2.1, Part R of the Rules** means a system approved in accordance with both the "*Revised Guidelines for the Approval of Equivalent Water-based Fire-extinguishing Systems for Machinery Spaces and Cargo Pump Rooms*" (*MSC/Circ.*1165) (including amendments made by *MSC.*1/*Circ.*1269 and *MSC.*1/*Circ.*1386) and *MSC.*1/*Circ.*1458.

R27.2.2 Equivalent Water-mist Fire-extinguishing Systems

"Approved system" specified in **27.2.2, Part R of the Rules** means a system approved in accordance with both the "*Revised Guidelines for the Approval of Equivalent Water-based Fire-extinguishing Systems for Machinery Spaces and Cargo Pump Rooms*" (*MSC/Circ.*1165) (including amendments made by *MSC.*1/*Circ.*1269 and *MSC.*1/*Circ.*1386) and *MSC.*1/*Circ.*1458.

R27.2.3 Fixed Water-based Fire-fighting Systems for Ro-ro Spaces and Vehicle Spaces

"Approved system" specified in **27.2.3, Part R of the Rules** means a system which complies with the "*Revised Guidelines for the Design and Approval of Fixed Water-based Fire-fighting Systems for Ro-ro Spaces and Special Category Spaces*" (*MSC.*1/*Circ.*1430/Rev.3) and is approved by the Administration or deemed appropriate by the Society.

R28 AUTOMATIC SPRINKLER, FIRE DETECTION AND FIRE ALARM SYSTEMS

R28.2 Engineering Specifications

R28.2.1 General Requirements

1 The wording "a necessary precaution" specified in **28.2.1-1, Part R of the Rules** means supplying the compressed air automatically corresponding to decrease of air pressure in dry pipe system.

2 An approved equivalent system specified in **28.2.1-2, Part R of the Rules** is to be approved by the Society or organizations deemed appropriate by the Society in accordance with the "*Revised Guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS regulation II-2/12* (*IMO Res. A.*800(19))"(including amendments made by *IMO Res. MSC.*265(84)) and "*Unified Interpretation of Chapter 8 of the FSS Code and the Revised Guidelines for Approval of Sprinkler Systems Equivalent to that referred to in SOLAS Regulation II-2/12* (*Resolution A.*800(19)), *as amended by resolution MSC.*265(84) (*MSC.*1/*Circ.*1556)".

R29 FIXED FIRE DETECTION AND FIRE ALARM SYSTEMS

R29.2 Engineering Specifications

R29.2.1 General Requirements

1 In applying **29.2.1-2(4), Part R of the Rules**, watertight doors complying with **2.2.2.3, Part 1, Part C of the Rules** which also serve as fire doors are not to close automatically in the case of fire detection.

2 In applying **29.2.1-5, Part R of the Rules**, reference is made to the "*General Requirements for Electromagnetic Compatibility for All Electrical and Electronic Equipment*" (*IMO Res. A*.813(19)).

R29.2.2 Sources of Power Supply

"30 *minutes*" specified in **29.2.2-4, Part R of the Rules** means the last 30 *minutes* of the 18-*hour* time period required by **3.3, Part H of the Rules**.

R29.2.3 Component Requirements

1 With respect to the requirements of **29.2.3-1(1), Part R of the Rules**, in spaces such as provision refrigerating chambers in the accommodation spaces where a state of low temperature is maintained, if means are provided in the temperature control system so that audible and visible alarms are generated on the control panel and indicating unit in the event that the temperature of such spaces rises abnormally, the temperature control system may be deemed as the detectors specified in the above-mentioned requirements.

2 In applying **29.2.3-1(7), Part R of the Rules**, reference is made to the "*Guidelines for Approval of Fixed Fire Detection and Fire Alarm Systems for Cabin Balconies*" (*MSC*.1/*Circ*.1242).

R29.2.4 Installation Requirements

1 With respect to the requirements of **29.2.4-2(1), Part R of the Rules**, precautions are to be taken on the following items:

(1) Constant temperature type spot detectors or compensation type spot detectors are not to be provided at the following spaces:
  (a) Spaces exposed to outside air flow where generation of fire at such spaces cannot be detected efficiently.
  (b) Spaces where the temperature tends to rise significantly high (except for spaces where vapour or smoke is generated at all times such as saunas, galleys, etc.).
  (c) Spaces where the detectors are installed by 8 *m* or more apart from the floor surface of detection.
  (c) Spaces where the difference between the nominal initiating temperature or nominal settle point of temperature and the maximum ambient temperature of such spaces in normal condition is less than 20°C.

(2) Ionizing type or photovoltaic type detectors are not to be provided at the following spaces:
  (a) Spaces where a great deal of dusts, fine particles or water vapours tend to be accumulated.
  (b) Spaces where corrosive gases are likely to be generated.
  (c) Spaces where smoke tends to stagnate in normal condition.
  (d) In case of the photovoltaic type detectors, when the detectors are installed by 15 *m* apart from the floor surface of detection.

2 With respect to the requirements of **29.2.4-2(3), Part R of the Rules**, detectors provided at inside the stairway enclosures are, in principle, to be installed on the ceiling of the upper deck of the two decks which are connected by the stairs (See **Fig.R29.2.4-1(1)**). However, in cases where the stairway enclosure is continuous throughout the all decks, one detector is to comply with the requirements specified in **29.2.4-2(3), Part R of the Rules** and to be located at every intervals not exceeding 11 *m* (See **Fig.R29.2.4-1(2)**).

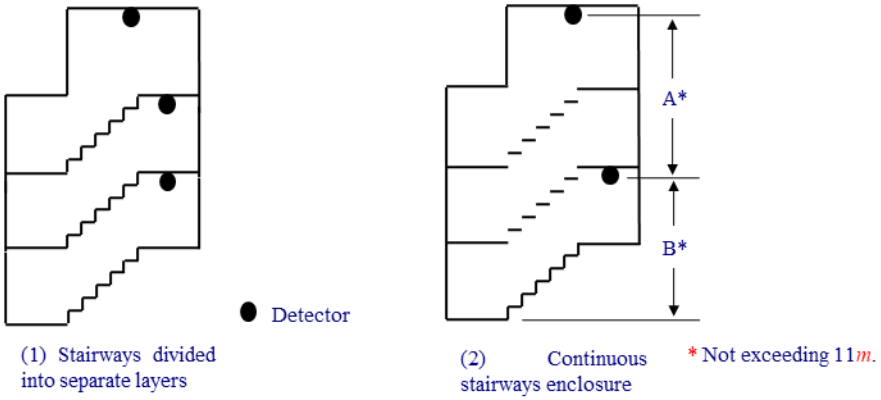
R29.2.5 System Control Requirements

1 For the audible alarm specified in **29.2.5-1, Part R of the Rules**, reference is made to the "*Code on Alerts and Indicators, 2009*" (*IMO Res. A*.1021(26)).

2 "Tested using procedures having due regard for such locations" in **29.2.5-2, Part R of the Rules** reference is to be made to *IEC* 60068-2-1.

3 With respect to the requirements of **29.2.5-1(3), Part R of the Rules**, a space in which a cargo control console is installed, but does not serve as a dedicated cargo control room (for example, office, machinery control room), is to be regarded as a cargo control room and is required to be provided with an additional indicating unit.

Fig. R29.2.4-1 Arrangements of Fire Detectors within Stairway Enclosures



R30 SAMPLE EXTRACTION SMOKE DETECTION SYSTEMS

R30.2 Engineering Specifications

R30.2.2 Component Requirements

With respect to the requirements of **30.2.2-1, Part R of the Rules**, smoke density is referred to in the note of **R29.2.3-2(1)**.

R30.2.3 Installation Requirements

With respect to the requirements of **30.2.3-2(2), Part R of the Rules**, sampling pipes are to be laid with an appropriate inclination and provided with drain connection at suitable location and all bends are to be provided with radii as large as practicable.

R30.2.4 System Control Requirements

With respect to the requirements of **30.2.4-1(2), Part R of the Rules**, if the fixed gas fire-extinguishing system discharge pipes are used for the sample extraction smoke detection system, the control panel may be located in the "CO2 Room" where the fire extinguishing medium (CO2) for a fixed gas fire-extinguishing system is stored. In such cases, an indicating unit is to be located on the navigation bridge.

R31 LOW LOCATION LIGHTING SYSTEMS

R31.2 Engineering Specifications

R31.2.1 General Requirements

The approved low location lighting systems specified in **31.2.1, Part R of the Rules** means those which have passed the test by organizations authorized by the Administration or deemed appropriate by the Society in accordance with the "*Guidelines for the evaluation, testing and application of low-location lighting on passenger ships*" (*IMO Res. A.*752(18)) or *ISO* 15370 "*Low-location lighting on passenger ships*".

R32 FIXED EMERGENCY FIRE PUMPS

R32.2 Engineering Specifications

R32.2.2 Component Requirements

1 In cases where a fixed water-based fire-extinguishing system installed for the protection of the machinery space in accordance with **10.5, Part R of the Rules** is supplied by the emergency fire pump then the following **(1)** to **(3)** are to be complied with.

(1) The emergency fire pump capacity is to be adequate to supply the fixed fire-extinguishing system at the required pressure plus two jets of water.

(2) The required capacity of two jets of water is to be determined by **Table R32.2.2-1** based on the biggest nozzle size available on board (the nozzles located in the space where the main fire pumps are located are to be excluded).

(3) With respect to the provisions of **32.2.2-2, Part R of the Rules**, the pressure at any hydrants is to be not less than 0.27 N/mm^2.

Table R32.2.2-1 Capacity of Two Jets of Water

Nozzle size	12 *mm*	16 *mm*	19 *mm*
Capacity of two jets of water	25 m^3/h	32 m^3/h	47 m^3/h

2 With respect to the requirements of **32.2.2-3, Part R of the Rules**, the emergency fire pump is to be of self-priming type or equivalent thereto and is to be so arranged that they are immediately operable when in use.

3 With respect to the requirements of **32.2.2-3, Part R of the Rules**, the net positive suction head (NPSH) available for the fixed emergency fire pumps is to be greater than the net positive suction head (NPSH) required under all conditions given in the following **(1)** to **(4)**:

(1) Condition taking into account heave combined pitch in head seas under the lightest seagoing condition (including the ballast exchange condition if necessary). The amount of the drop in the waterline associated with heave combined pitch is to be subject to **Table R32.2.2-2** and **Fig. R32.2.2-1**;

(2) Condition taking into account heave combined roll in beam seas under the lightest seagoing condition (including the ballast exchange condition if necessary). The inclined angle associated with heave combined roll is to be 11 degrees for ships with bilge keels or 13 degrees for ships without bilge keels;

(3) A static condition with a level of 2/3 immersion of the propeller at even keel; and

(4) An arrival ballast condition without cargo and with 10% of stores and fuel remaining.

Table R32.2.2-2 Amount of Drop in Waterline

L (m)	75 and below	100	125	150	175	200	225	250	300	350 and above
φ ($deg.$)	4.5	4.0	3.2	2.7	2.3	2.1	1.8	1.7	1.6	1.5
H (m)	0.73	0.8	0.87	0.93	0.98	1.03	1.07	1.11	1.19	1.25

Notes:

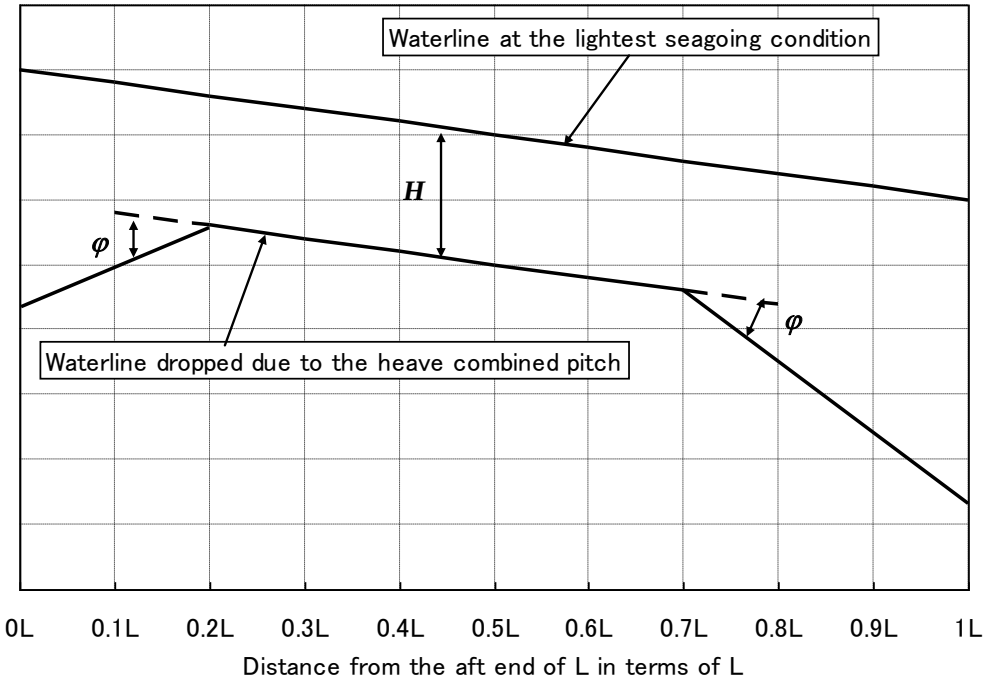
Values at the intermediate length of ships are to be obtained by linear interpolation.

L : Length of the ship as defined in **2.1.3, Part A of the Rules** or length between perpendiculars at the ballast draught, whichever is greater

φ : Pitch angle as defined in **Fig. R32.2.2-1**

H : Heave amplitude as defined in **Fig. R32.2.2-1**

Fig. R32.2.2-1 Amount of Drop in Waterline



4 With respect to the requirements of **32.2.2-1, Part R of the Rules**, on board cargo ships designed to carry five or more tiers of containers on or above the weather deck, the total capacity of the emergency fire pump need not exceed 72 m^3/h.

R32.2.3 Diesel Engines and Fuel Tank

With respect to the requirements of **32.2.3-2, Part R of the Rules**, gasoline engine is not to be used as a driving engine of fire pumps other than the portable emergency fire pumps.

R33 ARRANGEMENT OF MEANS OF ESCAPE

R33.2 Width and Inclination Angle of Means of Escape

R33.2.1 Width and Inclination Angle of Stairways and Corridors

With respect to the requirements of **33.2.1, Part R of the Rules**, the width and continuity of means of escape are to be in accordance with the following requirements as a minimum.

(1) Width of stairways and corridors not specified in **the Rules**: 600 *mm*

(2) Manholes including windows for means of escape: 600 × 400 *mm*

(3) Small hatches: 600 *mm* × 600 *mm* for a rectangular shape, 600 *mm* in diameter for a round shape

R34 FIXED DECK FOAM SYSTEMS

R34.2 Engineering Specifications

R34.2.2 Component Requirements

1 The wording "approved foam concentrates" referred to in **34.2.2-1(4), Part R of the Rules** means those approved by organizations authorized by the Administration or deemed appropriate by the Society with reference to the "*Revised Guidelines for the Performance and Testing Criteria, and Surveys of Foam Concentrates for Fixed Fire-extinguishing Systems*" (*MSC.*1/*Circ.*1312).

R34.2.3 Installation Requirements

1 With respect to the provisions of **34.2.3-1, Part R of the Rules**, the major equipment except their controls, such as the foam concentrate tank and the pumps, may be located in the engine room.

2 The wording "monitor" specified in **34.2.3-2, Part R of the Rules** means the water spray and which can be held in any arbitrary direction and be fixed. Hereinafter, the same is referred to.

3 The "applicators" specified in **34.2.3-3, Part R of the Rules** are to be provided with hoses complying with the provisions of **R10.2.3-1**.

4 The port and starboard monitors specified in **34.2.3-2(3), Part R of the Rules** may also be located in the cargo area above oil bunker tanks adjacent to cargo tanks if capable of protecting the deck below and aft of each other.

R35 INERT GAS SYSTEMS

R35.2 Engineering Specifications

R35.2.2 Requirements for All Systems

1 In case where plastic pipes are used for the drainage piping from the scrubber and blower fan casing specified in **35.2.2-1(3), Part R of the Rules**, the following requirements are to be complied with:

(1) The materials, design requirements, piping arrangements, connections of pipes, tests and inspections are to be as specified in **Annex 12.1.6, Part D of the Rules**.

(2) In case where glass-fibre reinforced plastic pipes are provided inside the machinery space, the following requirements are to be complied with:

(a) A valve operable from both inside and outside the machinery space either by pneumatic or hydraulic pressure led through steel piping is to be provided on a distance piece fitted to the shell plating. This valve is to be of automatic closing type in case of failure of the operating system.

(b) The valve specified in **(a)** above is to be provided with an indicator showing the opening / closing condition.

(c) The valve specified in **(a)** above is to be closed at all time when the inert gas system is not in operation as well as in the event of a fire in the machinery space.

(d) For the valve specified in **(a)** above, a short piece of steel pipe or spool piece is to be fitted. Further, a swing type non-return valve is to be attached to the piece. The piece is to be provided with a drain pipe of an inside diameter of approximately 12.5 *mm* and a drain valve.

(e) On the inboard side of the non-return valve specified in **(d)** above, a short piece of steel pipe or spool piece provided with a drain pipe with an inside diameter of approximately 12.5 *mm* and a drain valve is to be fitted.

(f) The distance piece and valve specified in **(a)** above, and short piece of steel pipe or spool piece and swing type non-return valve specified in **(d)** and **(e)** above are to be of corrosion resistant materials or to be protected internally by rubber, glass fibers, epoxy resins or equivalent coating materials.

(g) Means for stopping the scrubber pump is to be provided outside the machinery space.

2 In the requirements of **35.2.2-1(4)** to **35.2.4(2), Part R of the Rules**, the wording “separate inert gas generators” means the machinery dedicated to the production and supply of flue gas as the inert gas and includes the inert gas blowers, combustion chambers, oil fuel pumps and burners, gas coolers/scrubbers and automatic combustion control devices and monitoring, alarm and safety devices.

3 Arrangements to ensure an effective isolation specified in **35.2.2-3(2)(g), Part R of the Rules** is to be of such an arrangement shown in **Fig. R35.2.2-3(2)(g)** as an example.

4 With respect to the requirements of **35.2.2-4(2)(b), Part R of the Rules**, where the system uses a separate inert gas generator, the oxygen content of the inert gas may be measured at the outlet side of the scrubber.

5 With respect to the requirements of **35.2.2-2(2), Part R of the Rules**, the automatic shutdown of the inert gas system and its components is to involve the following:

(1) shutdown of fans and closing of regulating valve for the following:

(a) high water level in scrubber (not applicable for N_2);

(b) low pressure/flow to scrubber (not applicable for N_2); or

(c) high-high temperature of inert gas supply.

(2) closing of regulating valve in the event of:

(a) high oxygen content (in excess of 5% by volume); or

(b) failure of blowers/fans or N_2 compressors.

(3) activation of double-block and bleed arrangement upon (for ships with double block and bleed replacing water seal):

(a) loss of inert gas supply; or

(b) loss of power

6 With respect to the requirements of **35.2.2-3(2)(b), Part R of the Rules**, unambiguous information regarding the operational

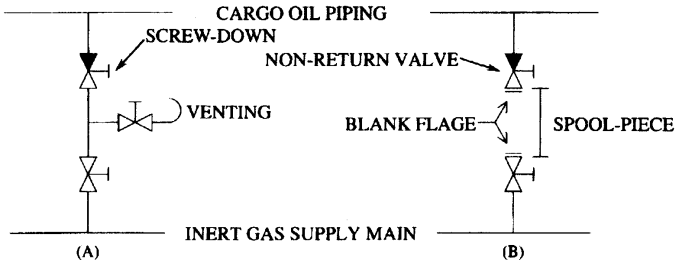
status of stop valves in branch piping leading from the inert gas main to cargo tanks means position indicators providing open/intermediate/closed status information in the control panel required in **35.2.2-4(1), Part R of the Rules**. Limit switches should be used to positively indicate both open and closed positions. Intermediate position status is to be indicated when the valve is in neither open nor closed position.

7 With respect to the requirements of **35.2.2-4(5)(c), Part R of the Rules**, the term "alarm system independent" means that a second pressure sensor, independent of the sensor serving the alarms for low pressure, high pressure and pressure indicator/recorder is to be provided. Notwithstanding the above, a common programmable logic controller (PLC) is, however, to be accepted for the alarms in the control system. The independent sensor is not to be required if the system is arranged for the shutdown of cargo pumps. If a system for shutdown of cargo pumps is arranged, an automatic system shutting down all cargo pumps is to be provided. The shutdown is to be alarmed at the control station. The shutdown is not to prevent the operation of ballast pumps or pumps used for bilge drainage of a cargo pump room.

8 The wording "forward of" referred to in **35.2.2-3(2)(a)** and **(f)**, and **35.2.2-4(2)(a), Part R of the Rules** is to be interpreted to mean "downstream of".

9 The operational status of the inert gas system referred to in **35.2.2-4(1), Part R of the Rules** is to be based on indication that inert gas is being supplied downstream of the gas regulating valve and on the pressure or flow of the inert gas mains downstream of the non-return devices. However, the operational status of the inert gas system as required by **35.2.2-4(1), Part R of the Rules** is not to be considered to require additional indicators and alarms other than those specified in **35.2.2-4, Part R of the Rules** and **35.2.3(2)** or **35.2.4(2), Part R of the Rules**, as appropriate.

Fig. R35.2.2-3 (2)(g)



10 The portable gas detectors required by **35.2.2-4(6), Part R of the Rules** may also be used as the portable instruments for measuring flammable vapour concentration required by **4.5.7(1), Part R of the Rules**. Such portable instruments, however, are to satisfy the provisions of **4.5.7(1)** and **35.2.2-4(6), Part R of the Rules**.

R35.2.3 Requirements for Flue Gas and Inert Gas Generator Systems

1 The gas regulating valve specified in **35.2.3(1)(b)i), Part R of the Rules** is to be provided with an indicator to show whether it is open or closed.

2 With respect to the requirements of **35.2.3(1)(c), Part R of the Rules**, the scrubber is generally to be installed on a suction side of the inert gas blowers except where a separate inert gas generator is provided.

3 The wording "an alternative supply of cooling water" specified in **35.2.3(1)(c)i), Part R of the Rules** means a stand-by cooling water. In this case, this pump may be used for other purposes.

4 With respect to the requirements of **35.2.3(2)(a), Part R of the Rules**, where the system uses a separate inert gas generator, the temperature and pressure of the inert gas may be measured at the outlet side of the scrubber.

R35.2.4 Requirements for Nitrogen Generator Systems

The wording "safe location" specified in **35.2.4(1)(i), Part R of the Rules** means the following **(1)** and **(2)**.

(1) Oxygen-enriched air is to be discharged at the following **(a)** to **(c)**:

(a) Locations outside of the hazardous areas specified in **1.1.5(1), Part H of the Rules**;

(b) Locations which are not within 3 *m* of areas traversed by personnel; and

(c) Locations which are not within 6 *m* of air intakes for machinery (engines and boilers) and all ventilation inlets

(2) Nitrogen-product enriched gas is to be discharged at the following **(a)** and **(b)**:

(a) Locations which are not within 3 *m* of areas traversed by personnel; and

(b) Locations which are not within 6 *m* of air intakes for machinery (engines and boilers) and all ventilation inlets/outlets.

R36 FIXED HYDROCARBON GAS DETECTION SYSTEMS

R36.2 Engineering Specifications

R36.2.1 General Requirements

The approved fixed hydrocarbon gas detection systems specified in **36.2.1-1, Part R of the Rules** means the one approved by organizations authorized by the Administration or deemed appropriate by the Society with reference to the "*Guidelines for the design, construction and testing of fixed hydrocarbon gas detection system*" (*MSC.*1/*Circ.*1370).

R36.2.2 Component Requirements

1 The flame arresters specified in **36.2.2-2(1)(b), Part R of the Rules** can use flame screens. Both flame arresters and flame screens are to comply with the requirements of **R4.5.3-3**. In addition, sample gas is to be led to the atmosphere with outlets provided with such devices.

2 The "safe location" for the arrangement of discharge outlets specified in **36.2.2-2(1)(b), Part R of the Rules** is to be at a horizontal distance not less than 3 *m* from the nearest air intake, discharge outlet or opening to accommodation spaces, service spaces and control stations, or other non-hazardous locations.

3 A visual and audible alarm is to be provided to notify the shutting down of the gas analysing unit specified in **36.2.2-2(1)(d), Part R of the Rules**. The alarm signal is to be provided in the cargo control room and navigation bridge.

4 Copper pipes may be used for sample pipes as the equivalent material specified in **36.2.2-2(1)(e), Part R of the Rules**.

5 Bulkhead penetrations of sample pipes between safe and dangerous areas are to have the same fire integrity as the division penetrated by an equivalent construction or fittings to those specified in **R9.3**.

R37 Helicopter Facility Foam Firefighting Appliances

R37.3 Engineering Specifications

R37.3.7 Performance of Hose Reels, Monitors and Deck Integrated Foam Nnozzles

With respect to the requirements of **37.3.7-2, Part R of the Rules**, reference is made to following standards for deck integrated foam nozzles.

(1) *BS EN 13565-1:2003+A1:2007*

(2) Standards which are acceptable to the Administration

R37.3.9 Foam Concentrates

For the performance standards "acceptable to the Society" specified in **37.3.9, Part R of the Rules**, reference is to be made to either "*the International Civil Aviation Organization Airport Services Manual, part 1 Rescue and Fire Fighting, chapter 8 Extinguishing Agent Characteristics, paragraph 8.1.5, Foam specifications table 8-1, Performance Level B*" or "*Revised Guidelines for the performance and testing criteria, and surveys of foam concentrates for fixed-extinguishing systems*" (*MSC*.1/*Circ*.1312).

R37.3.10 Height of Obstacle

1 With respect to the requirement of **37.3.10, Part R of the Rules**, the permitted height for foam firefighting system is as following **(1)** or **(2)**.

(1) Cases where the helicopter lands at the ship's side

(a) Permitted height for foam firefighting system is to be as given in "*The International Chamber of Shipping Guide to Helicopter/Ship Operations (4th edition), Chapter 4 Figure 4.1*". (See **Fig. R37.3.10-1**)

(b) Notwithstanding **(a)** above, foam firefighting systems exceeding the height specified in **Fig. R37.3.10-1** are acceptable where the following **i)** and **ii)** measures are taken.

i) Clearly marking the systems

ii) Providing written information to the helicopter operator

(2) Cases where the helicopter lands at the amidships centreline

(a) Permitted height for foam firefighting system is a height that does not exceed *OBSTACLE HEIGHT LIMITS* which is defined by "*The International Chamber of Shipping Guide to Helicopter/Ship Operations (4th edition)*, *Chapter 4 Figure 4.2*". (See **Fig. R37.3.10-2**) In **Fig. R37.3.10-2,** permitted height for foam firefighting systems within the central clear zone is 0.025 *m*.

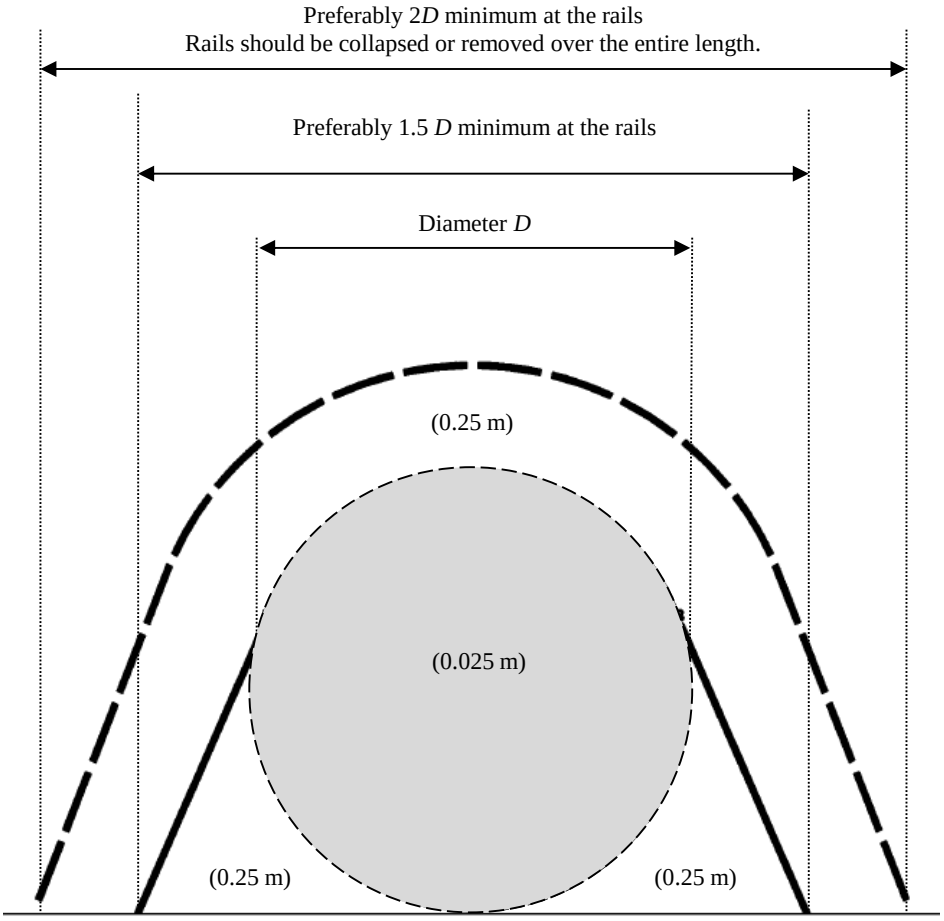
(b) Notwithstanding **(a)** above, foam firefighting appliances exceeding the heights specified in **Fig. R37.3.10-2** are acceptable where the following **i)** and **ii)** measures are taken. However, even if these measures are taken, foam firefighting systems installed within obstacle free sectors, including the central clear zones, are not to exceed a height of 0.25 *m*.

i) Clearly marking the systems

ii) Providing written information to the helicopter operator

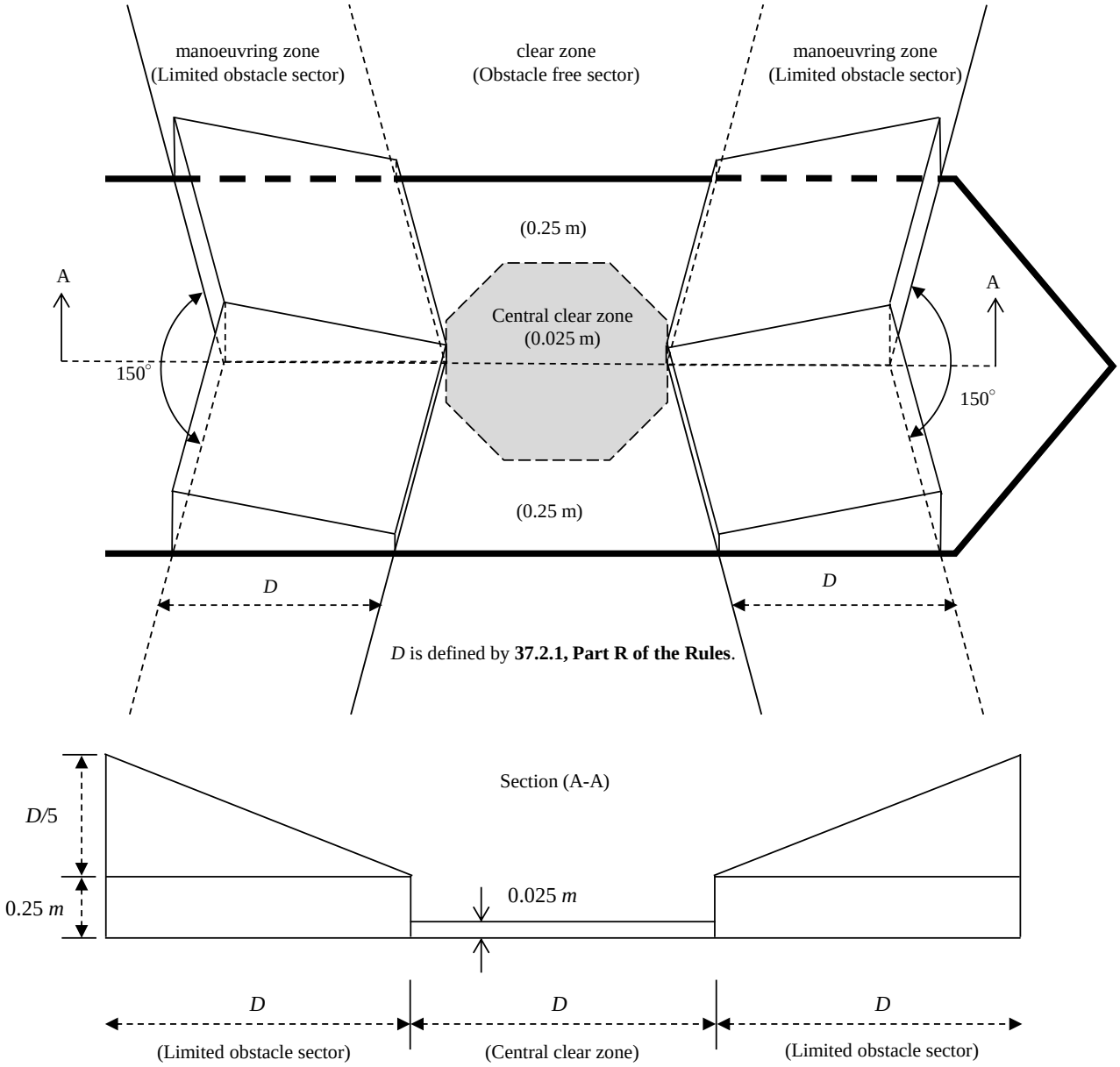
2 Notwithstanding **-1** above, reference is to be made to **17.3.2(3)** or **17.3.3(3), Part P of the Rules** where single main rotor helicopters are used for structures that are positioned for a long period of time or semi-permanently at a specific sea area and that comply with the requirements in **Part P of the Rules**.

Fig. R37.3.10-1 Permitted height for foam appliance (at the ship's side)



D is defined by **37.2.1, Part R of the Rules**.

Fig. R37.3.10-2 Permitted height for foam appliance (at amidships centreline)



Annex R5.3.1-1 DETAILS OF FIRE PROTECTION MATERIALS

1 FIRE PROTECTION MATERIALS FOR CARGO SHIPS

1.1 Restricted Use of Combustible Materials and Details of Construction

Following figure and tables show the details on the requirements specified in **4.4.4**, **5.3**, **6.2.1** and **6.3.1, Part R of the Rules** for every subject of members fitted in accommodation spaces, service spaces and control stations. The requirements for Method I*C* and for Method II*C* and III*C* are summarised in accordance with **Table 1** and **Table 2** respectively.

Fig. 1

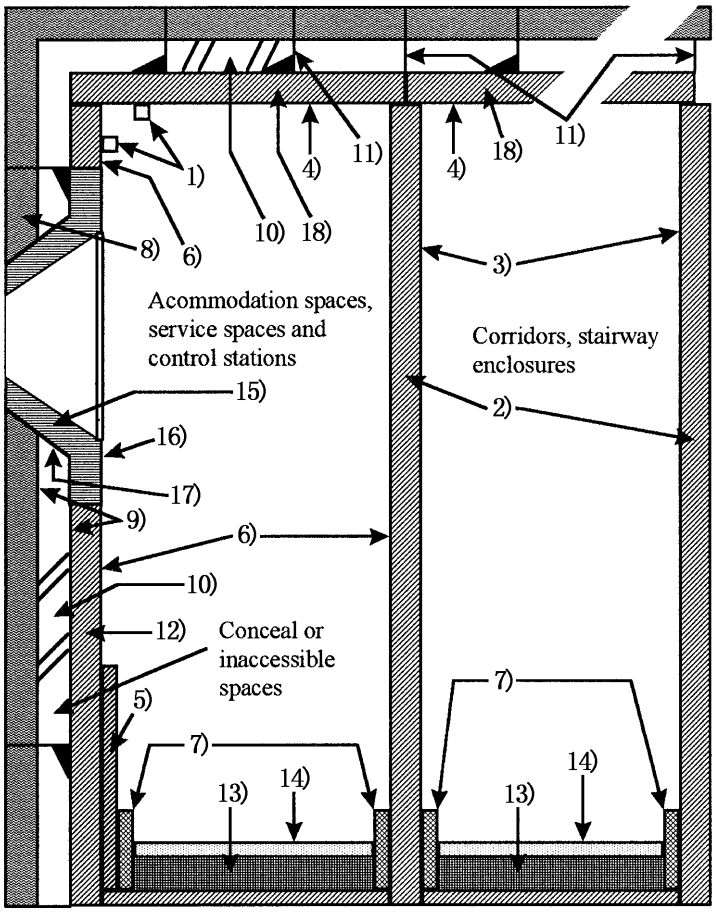


Table 1 Method *IC*

Requirements		Non combustible material	Non combustible material	Low flame spread	Equivalent volume	Calorific value	Smoke production	Not readily ignited
Part R of the Rules		**5.3.1-2**	**5.3.1-1**	**5.3.2-4**	**5.3.2-1**	**5.3.2-2**	**6**	**4.4.4**
1)	Moulding				○			
2)	Panel	○						
3)	Painted surface or Veneer or Fabric or Foils			○	○	○	○(2)	
4)	Painted surface or Veneer or Fabric or Foils			○	○	○	○(2)	
5)	Decoration				○		○	
6)	Painted surface or Veneer or Fabric or Foils				○	○	○(2)	
7)	Skirting board				○			
8)	Insulation		○(1)					
9)	Surfaces and paints in concealed or inaccessible spaces			○				
10)	Draught stop	○						
11)	Grounds and supports	○		○				
12)	Lining	○						
13)	Primary deck covering 1st layer						○	○
14)	Floor finishing			○(3)			○	
15)	Window box	○						
16)	Window box surface			○	○	○	○	
17)	Window box surface in concealed or inaccessible spaces			○				
18)	Ceiling panel	○						

Notes:

(1) Vapour barriers used on pipes for cold services (see **R5.3.1-2**) may be combustible materials providing that their surface has low flame spread characteristics. (**5.3.1-1, Part R of the Rules**)

(2) Applicable to paints, varnishes and other finishes (**6.2.1, Part R of the Rules**)

(3) Only in corridors and stairway enclosures

Table 2 Method II*C* and III*C*

Requirements		Non combustible material	Non combustible material	Low flame spread	Equivalent volume	Calorific value	Smoke production	Not readily ignited
Part R of the Rules		**5.3.1-2**	**5.3.1-1**	**5.3.2-4**	**5.3.2-1**	**5.3.2-2**	**6**	**4.4.4**
1)	Moulding				○(3)			
2)	Panel	○(4)						
3)	Painted surface or Veneer or Fabric or Foils			○	○	○	○(5)	
4)	Painted surface or Veneer or Fabric or Foils			○	○(3)	○(2)	○(5)	
5)	Decoration				○(3)		○	
6)	Painted surface or Veneer or Fabric or Foils				○(3)	○(2)	○(5)	
7)	Skirting board				○(3)			
8)	Insulation		○(1)					
9)	Surfaces and paints in concealed or inaccessible spaces			○				
10)	Draught stop	○(4)						
11)	Grounds and supports	○(4)		○				
12)	Lining	○(4)						
13)	Primary deck covering 1st layer						○	○
14)	Floor finishing			○(6)			○	
15)	Window box	○(4)						
16)	Window box surface			○(3)	○(3)	○(2)	○	
17)	Window box surface in concealed or inaccessible spaces			○				
18)	Ceiling panel	○(4)						

Notes:

(1) Vapour barriers used on pipes for cold services (see **R5.3.1-2, Part R of the Guidance**) may be combustible materials providing that their surface has low flame spread characteristics. (**5.3.1-1, Part R of the Rules**)

(2) Where the material is fitted on non-combustible bulkheads, ceiling on lining in accommodation and service spaces. (**5.3.2-2, Part R of the Rules**)

(3) To be applied to those accommodation and service spaces bounded by non-combustible bulkheads, ceiling and linings. (**5.3.2-3(1), Part R of the Rules**)

(4) Only in corridors and stairway enclosures serving accommodation and service spaces and control stations. (**5.3.1-2(2), Part R of the Rules**)

(5) Applicable to paints, varnishes and other finishes (**6.2.1, Part R of the Rules**)

(6) Only in corridors and stairway enclosures

Annex R9.3.1DETAILS OF PENETRATIONS

1 GENERAL

1.1 Principle

1.1.1 Penetration in "*A*" Class Divisions

For penetrations in "*A*" class divisions, details are to be approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code. For other penetrations such that testing is not required under the provisions of **9.3.1** or **9.7.3, Part R of the Rules** as applicable, details are to comply with the provisions in sections **2.1** and **2.2** of this Annex as a standard.

1.1.2 Penetration in "*B*" Class Divisions

For penetrations in "*B*" class divisions, details are to be such that the fire resistance is not impaired and to comply with the provisions of **chapter 2** of this Annex as a standard. However, for a penetration which is tested and approved by the Society or organizations deemed appropriate by the Society in accordance with the Fire Test Procedures Code, this requirements may not be applied.

1.1.3 Prevention of Heat Transmission

For penetrations in "*A*" class divisions other than "*A*-0" class or in "*B*" class divisions other than "*B*-0" class, the insulation of a division is to be carried past such penetrations for a distance of at least 450 *mm* in the case of steel and aluminium structures.

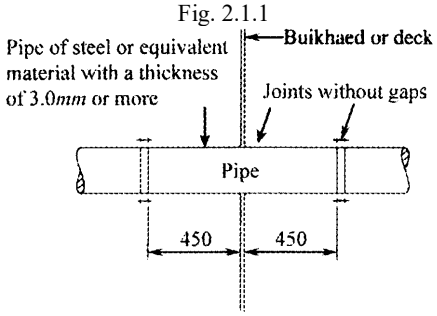
2 DETAILS

2.1 Penetration of Pipes

2.1.1 Penetration in "*A*" Class Divisions

Where a pipe penetration made of steel or equivalent material having thickness of 3 *mm* or more and a length of not less than 900 *mm* (preferably 450 *mm* on each side of the division), and no openings, testing in accordance with the Fire Test Procedures Code is not required. (See **Fig. 2.1.1**)

Fig. 2.1.1



2.1.2 Penetration in "*B*" Class Divisions

1 A pipe penetration is to be made by a steel or copper pipe having thickness of not less than 1.8 *mm*, a penetration piece, or a steel sleeve. When a penetration piece or steel sleeve is used, the penetration is to have a length of not less than 900 *mm* for pipe outside diameters of 150 *mm* or more and not less than 600 *mm* for pipe outside diameters of less than 150 *mm* (preferably equally divided to each side of the division). (See **Fig. 2.1.2-1**)

2 Where a steel penetration piece is used as a pipe penetration, the pipe is to be connected to the ends of the penetration piece by flanges or couplings. (See **Fig. 2.1.2-2**)

3 Where a steel sleeve is used as a pipe penetration, the clearance between the sleeve and 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. (See **Fig. 2.1.2-3**)

Fig. 2.1.2-1

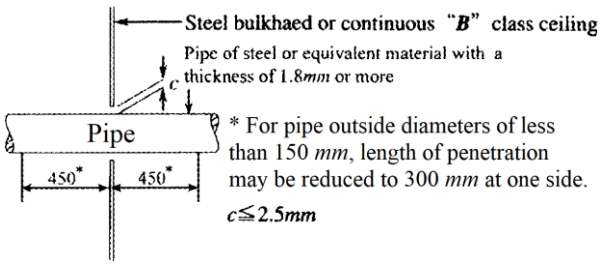


Fig. 2.1.2-2

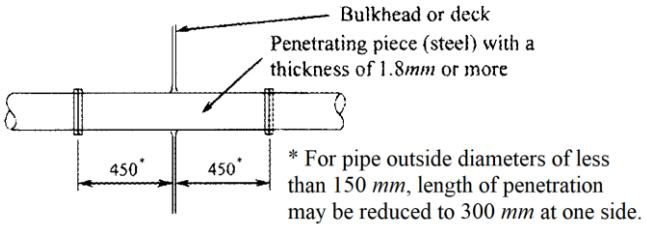
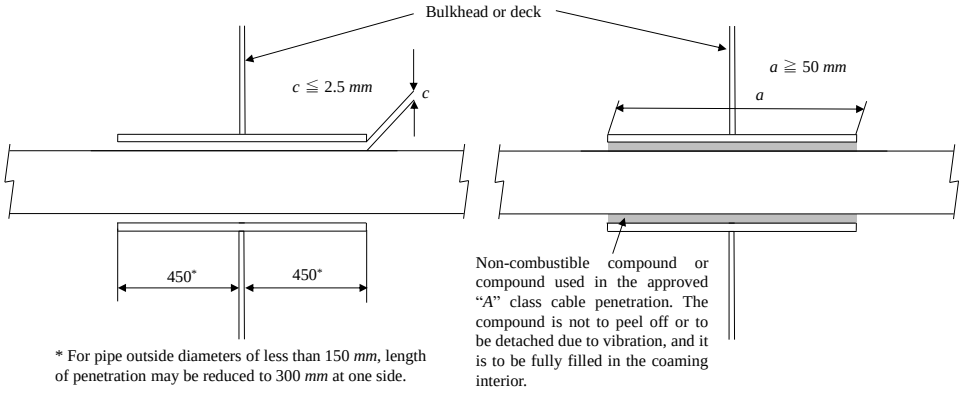


Fig. 2.1.2-3



2.1.3 Prevention of Heat Transmission

1 Where a pipe penetrates in a deck or a bulkhead which is required to be insulated, the insulation is to be carried past the penetration for a distance at least 450 *mm*. (See **Fig. 2.1.3-1**)

2 Notwithstanding **-1** above, for a penetration of a pipe made of material having low-heat conductivity character (e.g. a metalic pipe) and an outside diameter of less than 150 *mm* in a "*B*" class division, the insulation may be terminated at the end of penetration piece or sleeve as required. (See **Fig. 2.1.3-2**)

Fig. 2.1.3-1

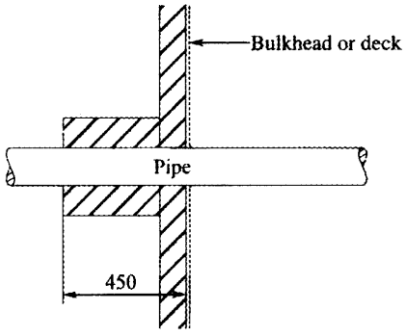
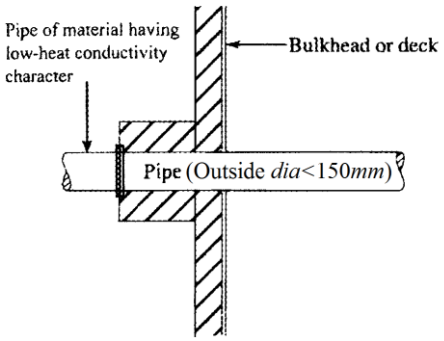


Fig. 2.1.3-2



2.2 Penetration of Ducts

2.2.1 Penetration in "*A*" Class Divisions

1 A duct penetration is to be made of steel or equivalent material having thickness of at least 3 *mm* and a length defined as **Table 2.2.1**, preferably equally divided to each side of the bulkhead (see **Fig. 2.2.1**) or, in the case of the deck, totally laid on the lower side

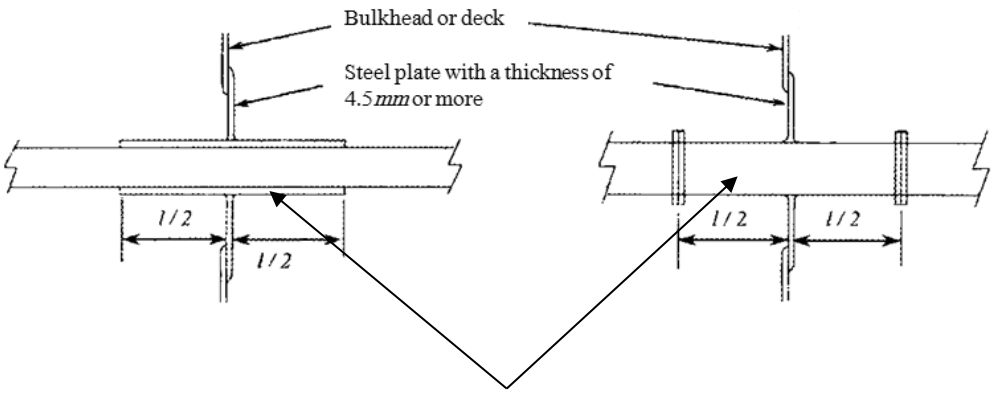
of the deck as practicable. In particular, when a duct with a free cross-sectional area equal to, or less than, 0.02 m^2 passes through "*A*" class decks, a steel sleeve is to be wholly laid on the lower side of the decks penetrated.

2 Use of penetration pieces can be accepted in lieu of the steel sleeve specified in **9.7.1-2, Part R of the Rules**. (See **Fig. 2.2.1**)

Table 2.2.1 Length of penetration of ducts

Free cross-sectional area of duct penetrations	Length of penetrations (*l*)
0.02 m^2 or less	200 *mm*
Over 0.02 m^2	900 *mm*

Fig. 2.2.1



Thickness of steel (penetration piece, sleeve)

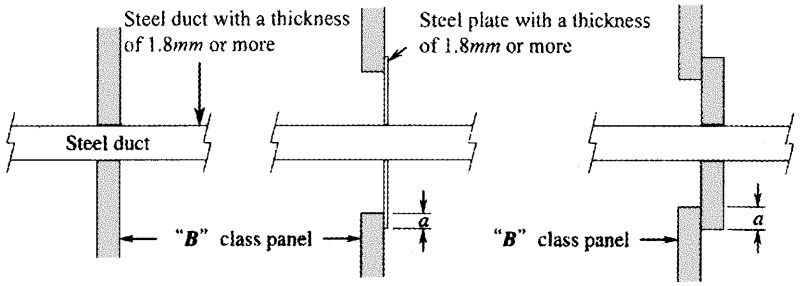
- Ducts with a free cross-sectional area equal to, or less than, 0.075 m^2 : At least 3.0 *mm*
- Ducts with a free cross-sectional area exceeding 0.075 m^2, but not more than 0.45 m^2: At least 4.0 *mm*
- Ducts with a free cross-sectional area of over 0.45 m^2 : At least 5.0 *mm*

2.2.2 Penetration in "*B*" Class Divisions

1 A duct penetration is to be made of steel or equivalent material having thickness of at least 1.8 *mm* and a length defined as **Table 2.2.1**, preferably equally divided to each side of the bulkhead (see **Fig. 2.2.2-1** and **Fig. 2.2.2-2**) or, in the case of the deck, totally laid on the lower side of the deck as practicable.

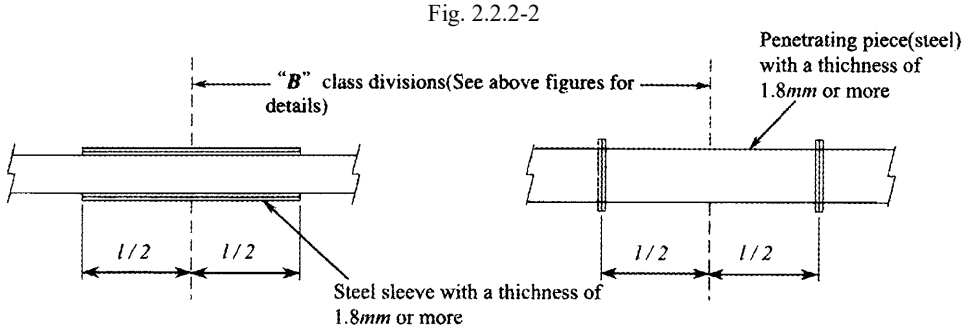
2 No clearance is to be allowed between ducts and divisions.

Fig. 2.2.2-1



a ≥ *T* where *T* is thickness of panel excluding finishes

Fig. 2.2.2-2

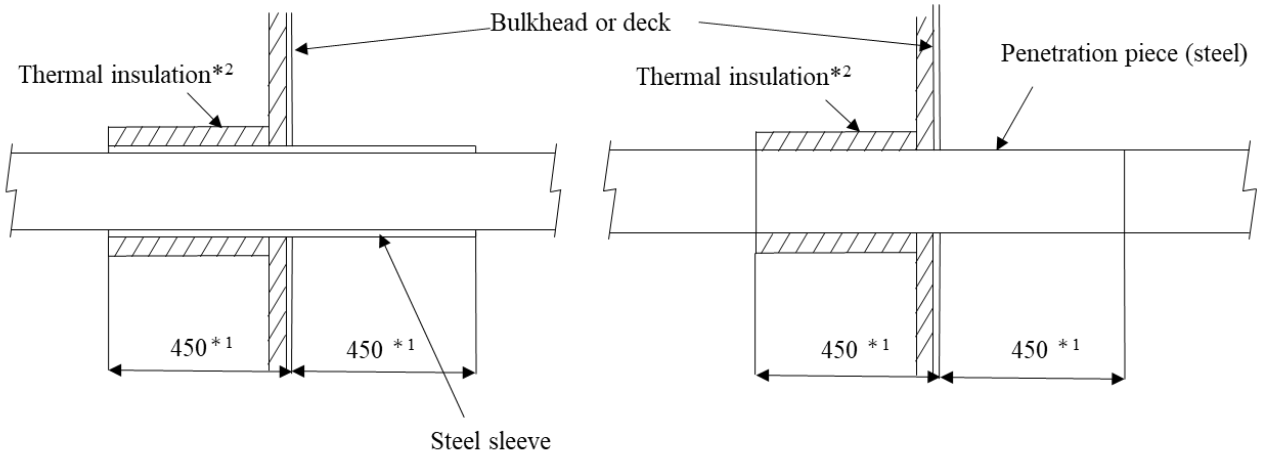


2.2.3 Prevention of Heat Transmission and Fire Dampers

1 The details of prevention of heat transmission at penetrations specified in **(1)** and **(2)** of **9.7.3-1, Part R of the Rules** are to be as shown in **Fig. 2.2.3-1** as a standard.

2 The details of prevention of heat transmission between automatic fire dampers and the divisions penetrated specified in **9.7.3-1(3), Part R of the Rules** are to be as shown in **Fig. 2.2.3-2** and **Fig. 2.2.3-3** as a standard.

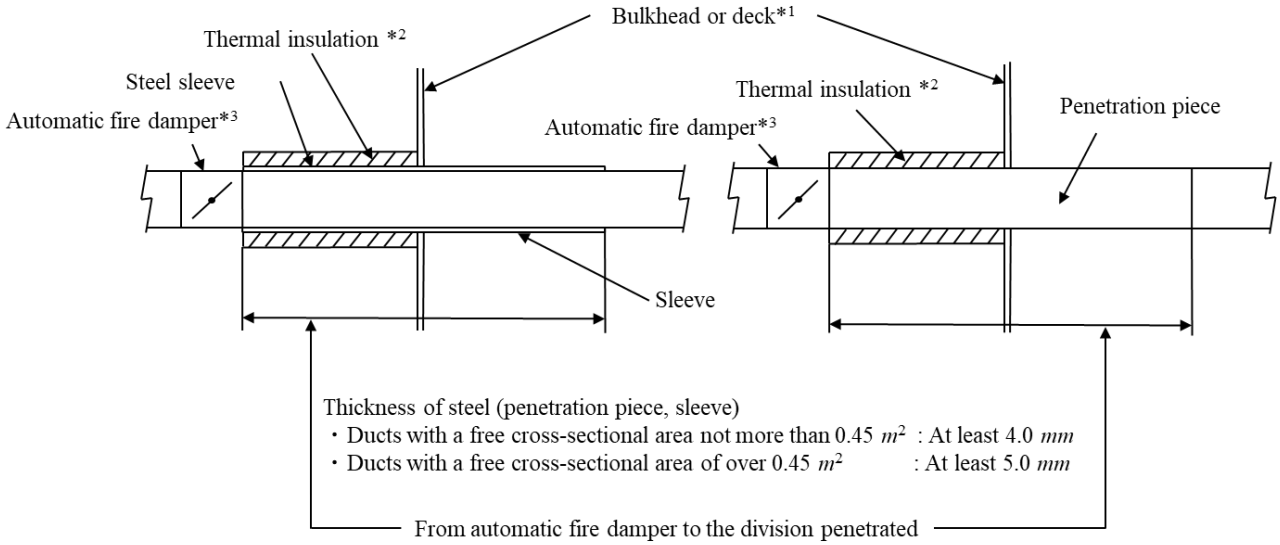
Fig. 2.2.3-1 A duct penetration with a free cross-sectional area equal to, or less than, 0.075 m^2



*1 A penetration of a duct made of material having low-heat conductivity character and with a free cross-sectional area not greater than 0.02 m^2, the insulation may be terminated at the end of penetration piece or sleeve specified in **2.2.1**.

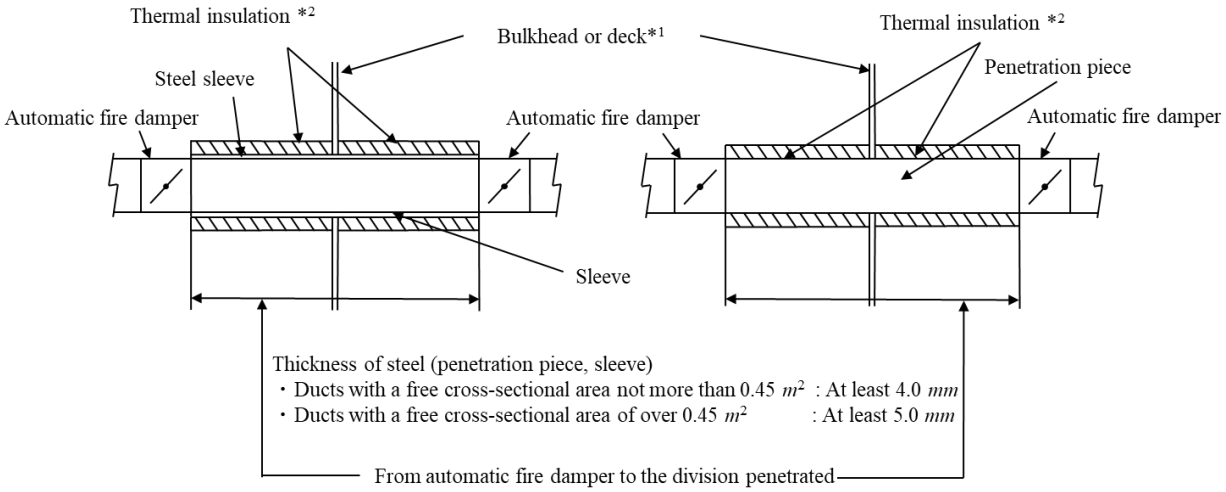
*2 Thermal insulation is to be provided only to the part of the duct and/or sleeve that is on the same side of the division being fire insulated, and be extended for a minimum of 450mm along the duct and/or sleeve.

Fig. 2.2.3-2 A duct penetration with a free cross-sectional area of over 0.075 m^2
(Damper provided on one side of the division.)



*1 Thermal insulation is to be fitted, if insulation is required by the Rules.
*2 Thermal insulation same level of fire integrity of the penetrated bulkhead or deck to be fitted.
*3 When the equipment for operating the automatic fire dampers penetrate the divisions, such penetrations are to be properly constructed as required by **9.3.1, Part R of the Rules**.

Fig. 2.2.3-3 A duct penetration with a free cross-sectional area of over 0.075 m^2
(Dampers provided on both sides of the division.)



*1 Thermal insulation is to be fitted, if insulation is required by the Rules.
*2 Thermal insulation same level of fire integrity of the penetrated bulkhead or deck is to be fitted.

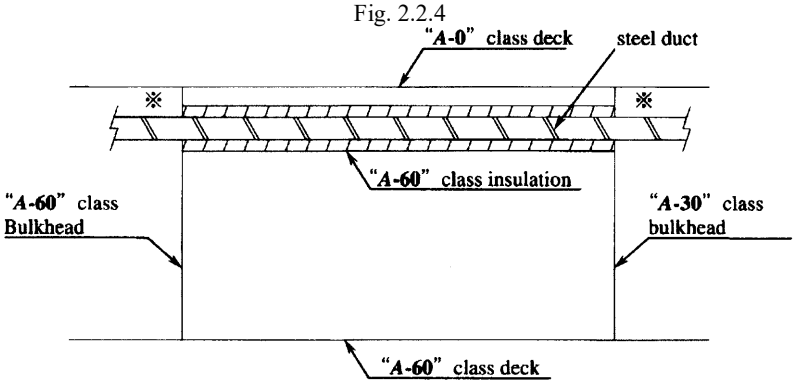
2.2.4 Omission of Dampers

The automatic fire dampers required in 2.2.3-2 may be omitted if the following conditions are satisfied with:

(1) Where the ducts run through spaces surrounded by "*A*" class divisions, without serving these spaces.

(2) Where the ducts have the fire integrity compatible with that of the divisions with the highest insulation value among divisions penetrated by the ducts. (See Fig. 2.2.4)

Fig. 2.2.4



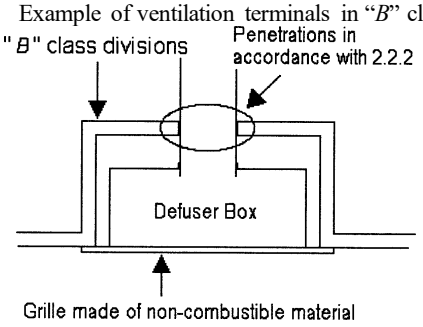
Note:

※ Penetrations through divisions are to be in compliance with Fig. 2.2.1.

2.2.5 Ventilation Terminals

An example of ventilation terminals in "*B*" class divisions is shown in Fig. 2.2.5.

Fig. 2.2.5 Example of ventilation terminals in "*B*" class divisions

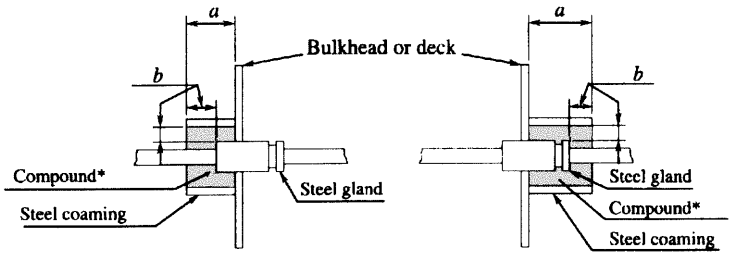


2.3 Penetration of Electric Cables

2.3.1 Penetration of "*A*" Class Divisions

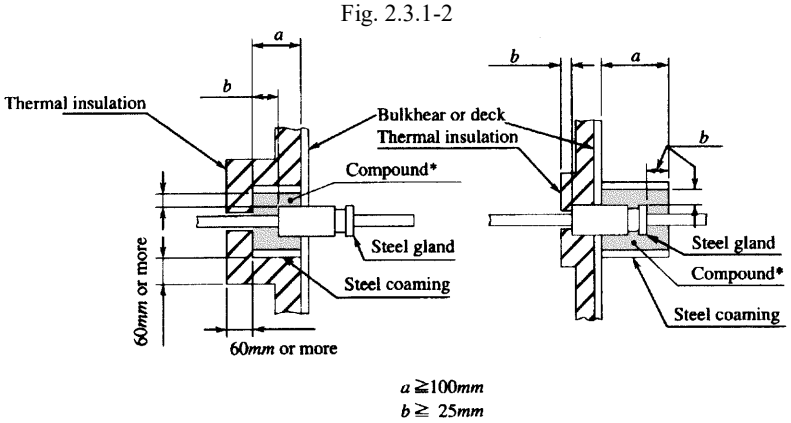
The requirements specified in H2.9.15 are to be complied with. Detailed examples of such penetrations are shown in Figs. 2.3.1-1 to 2.3.1-2.

Fig. 2.3.1-1
"A-0" Class Penetrations



$a \geqq 100mm$
$b \geqq 25mm$

Fig. 2.3.1-2



Note:

The compound marked ＊ is to be of non-combustible compound or of the compound used in the approved "*A*" class cable penetration.

2.3.2 Penetration of "*B*" Class Divisions

The requirements specified in H2.9.15 are to be complied with. Detailed examples of such penetrations are shown in Figs. 2.3.2-1 to 2.3.2-4.

Fig. 2.3.2-1

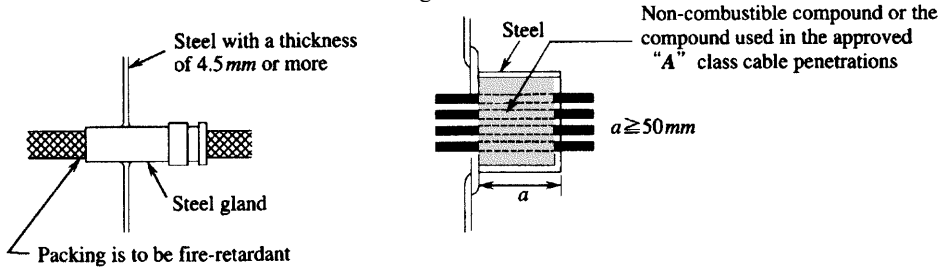


Fig. 2.3.2-2

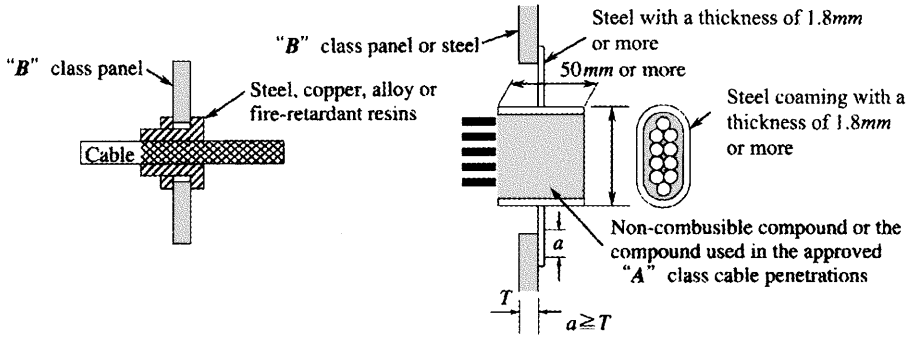


Fig. 2.3.2-3

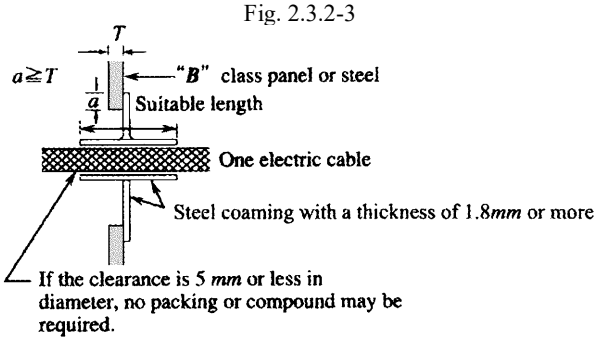
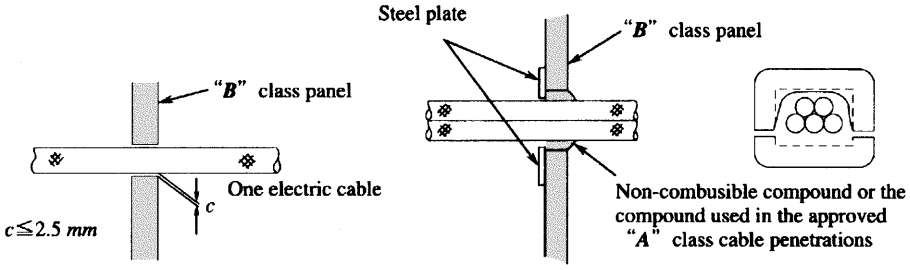


Fig. 2.3.2-4


"B" class panel
One electric cable
c
c≦2.5 mm
Steel plate
"B" class panel
Non-combusible compound or the
compound used in the approved
"A" class cable penetrations