

# *Polski Rejestr Statków*

## **RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS**

### **PART V FIRE PROTECTION**

2012



GDAŃSK

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**RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS** prepared and edited by Polski Rejestr Statków, hereinafter referred to as PRS, consist of the following Parts:

- Part I – Classification Regulations
- Part II – Hull
- Part III – Hull Equipment
- Part IV – Stability and Subdivision
- Part V – Fire Protection
- Part VI – Machinery Installations and Refrigerating Plants
- Part VII – Machinery, Boilers and Pressure Vessels
- Part VIII – Electrical Installations and Control Systems
- Part IX – Materials and Welding.

*Part V – Fire Protection – 2012*, was approved by the PRS Board on 20 June, 2012 and enters into force on 1 July, 2012.

From the entry into force, the requirements of *Part V – Fire Protection* apply, in full, to new ships.

For existing ships, the requirements of *Part V – Fire Protection* are applicable within the scope stated in *Part I – Classification Regulations* and as specified in Part SUPPLEMENT – RETROACTIVE REQUIREMENTS.

The requirements of *Part V – Fire Protection* are extended by the below-listed Publications:

- Publication No. 41/P – Symbols Related to Life-saving Appliances and Arrangements and Escape Routes. Guidelines for Passenger Safety Instructions.
- Publication No. 51/P – Procedural Requirements for Service Suppliers.
- Publication No. 53/P – Plastic Pipes on Ships.
- Publication No. 88/P – Guidelines on Safety for Natural Gas-fuelled Engine Installations in Ships.
- Publication No. 89/P – Guidelines on Designing, Performance of Type Tests of Fixed Fire-extinguishing Systems used on Ships.
- Publication No. 29/I – Guidelines for Periodical Inspections of Fire-Extinguishing Systems and Appliances Used on Ships.

IMO resolutions and circulars referred to in *Part V – Fire Protection* – see the list of reference IMO documents at the end of the *Part*.

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## 1 GENERAL

### 1.1 Application

**1.1.1** *Part V – Fire Protection* applies to the structural fire protection, fire-extinguishing systems and fire alarm systems, as well as to the arrangement of fire-fighting equipment in sea-going ships specified in 1.1.1, *Part I – Classification Regulations*.

**1.1.2** The requirements, specified in Chapters 1, 2, 3, 4, 5 and in Chapter 7 are applicable to cargo ship: general cargo ship assigned the mark GENERAL CARGO SHIP in the symbol of class and are the basic requirements for all other types of ships to be assigned an additional mark in the symbol of class specified in 3.4, *Part I – Classification Regulations*. Ships which are to be assigned an additional mark in the symbol of class shall additionally comply with the applicable requirements set forth in Chapter 6.

**1.1.3** For cargo ships of less than 500 gross tonnage, in lieu of certain requirements stated in Chapters 1, 2, 3, 4 and 5, less severe requirements, specified in 6.21, apply.

**1.1.4** Alternative/novel design or arrangements for fire safety deviating from the requirements specified in the present *Part* may be permitted, provided that the design and arrangements meet the fire safety objectives and the functional requirements, this being verified through approval of technical documentation and performance of appropriate tests.

**1.1.5** On ships subject to *SOLAS Convention*, alternative/novel design or arrangements for fire safety may be permitted, provided that:

- .1** engineering analysis of such alternative design/arrangement is carried out in accordance with guidelines set out in MSC/Circ.1002/Corr.1;
- .2** technical documentation and the engineering analysis of such alternative design/arrangement is approved by PRS;
- .3** where, for the purpose of the engineering analysis, tests of such design/arrangement or parts thereof are required, these tests will be carried out in the presence of PRS' Surveyor;
- .4** a certificate is issued by PRS demonstrating that alternative design/arrangement provides the equivalent level of safety to the requirements of *SOLAS Convention* in accordance with *SOLAS* regulation II-2/17.

Copies of the approved technical documentation and the engineering analysis, as well as of the certificate demonstrating that alternative/novel design or arrangements provide the equivalent level of safety to the requirements of *SOLAS* regulation II-2/17 shall be available on board the ship at all times, for the purpose of inspections.

## 1.2 Definitions

The definitions relating to the general terminology of the *Rules for the Classification and Construction of Sea-going Ships* (hereinafter referred to as the *Rules*) are given in *Part I – Classification Regulations*. Wherever, in *Part V*, definitions given in other Parts of the *Rules* are used, reference to these Parts is made.

For the purpose of *Part V*, the following definitions have been adopted:

- .1 Atria** – public spaces on passenger ships within a single main vertical zone spanning three or more open decks.
- .2 Cabin balcony** – an open deck which is provided for the exclusive use of the occupants of a single cabin and has direct access from such a cabin.
- .3 Total flooding** – filling the entire volume of the space with a fire-extinguishing agent (inert gas, high-expansion foam, water mist, etc.) in order that fire may be suppressed within that volume.
- .4 Chemical carrier** – for the purpose of *Part V*, chemical carrier means 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 the *IBC Code*.
- .5 Safety centre** – a control station (with regard to the requirements for passenger ships) dedicated to the management of emergency situations. Safety systems' operation, control and/or monitoring are an integral part of the safety centre.
- .6 Central control station** – a control station (with regard to passenger ships) in which the following control and indicator functions are centralized:
  - .1** a fixed fire detection and fire alarm systems;
  - .2** automatic sprinkler systems;
  - .3** fire door indicator panels;
  - .4** fire door closure;
  - .5** watertight door indicator panels;
  - .6** watertight door opening and closure;
  - .7** shutting off ventilation fans;
  - .8** general/fire alarms;
  - .9** internal communication systems including telephones; and
  - .10** public address systems microphones.
- .7 Continuously manned central control station** – a central control station (in passenger ships) which is continuously manned by a responsible member of the crew.
- .8 Flammable liquids** – liquids, liquid mixtures and suspended solids (paints, varnishes, etc.), which give off flammable vapours having a flash-point not exceeding 60 °C, determined in closed cup test.

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- .9 Lower flammable limit** – minimum concentration of flammable compound in air (or other oxidizing agent) below which the mixture will not ignite or above which a spontaneous propagation of flame may occur.
- .10 Means of escape** – a designated route ultimately leading from a compartment or ship area to the evacuation station, appropriately marked and lighted.
- .11 Directive MED** – *Council Directive 96/98/EC on Marine Equipment (MED) of 20 December 1996*, as amended, which specifies, with regard to fire protection, the requirements and the scope of certification of the equipment used on ships subject to SOLAS 74/78 Convention, as amended, flying the flag of EU Member State.
- .12 Escape** – an orderly movement of passengers and the crew to the evacuation station or any place of relative safety on open deck in the event of fire.
- .13 Gas carrier** – for the purpose of *Part V*, gas carrier means 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 the *IGC Code*.
- .14 Main fire-resisting division** – fire-resisting division (A Class division) forming boundary of the main vertical or horizontal zone, installed in passenger ships.
- .15 Main vertical zones** – sections (with regard to the requirements for passenger ships) into which the hull, superstructures and deckhouses are divided by A Class divisions, the mean length and width of which on any deck do not, in general, exceed 40 m.
- .16 Upper flammable limit** – maximum concentration of flammable agent in air (or other oxidizing agent) above which the mixture will not ignite.
- .17 Group of fires** – definition of fire depending on the type of burning material and the material burning process. The fires are subdivided into the following groups:
- Group A – fires of solid, usually organic materials such as wood, paper, coal, etc. which, when burning, involve also the phenomenon of glowing;
  - Group B – fires of flammable liquids, such as diesel oil, petrol, alcohols or solid substances which melt when exposed to the heat of the fire, such as grease, tar, etc.;
  - Group C – fires of flammable gases, such as: methane, acetylene, hydrogen, etc.;
  - Group D – fires of light metals and light metal alloys, such as magnesium, sodium, aluminium, etc.;
  - Group F or K – fires of edible oils and fat in galley appliances.
- .18 Fire-extinguishing systems** – active systems, intended for the supply of fire-extinguishing medium to the spaces/zones protected,



structurally fixed to the ship's hull and activated automatically or manually from outside the protected spaces/zones.

- .19 Water screen system – system which supplies water to vertical surfaces of bulkheads and exit trunks in order to protect them against the effects of fire. The system is also used for creating a narrow space filled with water droplets (water screen) in order to prevent the fire expansion. The system is activated manually from outside the protected spaces.
- .20 Automatic sprinkler system – fire-detecting and extinguishing system fitted with temperature sensors activated by predetermined temperature, starting automatically the supply of sprayed water by sprinklers in the area of the detected fire and actuating, in control station, the warning signal that the system is activated. The system is intended for extinction of fires in accommodation, service spaces or control stations where people may be present.
- .21 Water-spraying fire-extinguishing system – manually or automatically controlled fire-extinguishing system where water is supplied by spraying nozzles installed in the protected space or in the region of the protected machinery. The system is intended for extinction of fires in cargo spaces, machinery spaces, store-rooms and other similar spaces.
- .22 Fire signalling systems – systems intended for detecting the fire symptoms, i.e. smoke, temperature, flame or change in atmospheric conditions, as well as warning systems transmitting the warning signal that fire-extinguishing system will operate. Depending on the application, fire signalling systems are subdivided into:
  - fire detection and fire alarm system – a system designed for detecting the fire symptoms and transmitting, after automatic activation, the alarm signal to control station or other manned space;
  - warning system – a system transmitting the warning signal (visual and audible) to persons present in the protected space that the smothering system is on the point of being put into action.
- .23 Fire damper – a device installed in a ventilation duct which under normal conditions remains open allowing flow in the duct, and is closed during fire, interrupting the flow in the duct to restrict the passage of fire.
- .24 A manual fire damper – a fire damper intended to be closed manually in the event of fire by the crew.
- .25 An automatic fire damper – a fire damper which closes automatically in response to exposure to fire products.
- .26 IMSBC Code – the *International Maritime Solid Bulk Cargoes Code*, as amended.
- .27 BCH Code – *Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk*, as amended.

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- .28** FSS Code – the *International Fire Safety Systems Code*, as amended.
- .29** FTP Code – the *International Code for the Application of Fire Test Procedures*, as amended.
- .30** HSC Code – the *International Code of Safety for High-Speed Craft*, as amended.
- .31** IBC Code – the *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk*, as amended.
- .32** IGC Code – the *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk*, as amended.
- .33** IMDG Code – the *International Maritime Dangerous Goods Code*, as amended.
- .34** Structural fire protection – all passive means of fire protection intended for:
- preventing the fire hazard;
  - confining/retarding the expansion of fire and smoke on the ship;
  - ensuring safe evacuation of personnel from individual spaces and from the ship, as well as access to particular spaces during rescue and fire-fighting operations.
- .35** SOLAS Convention – *the International Convention for the Safety of Life at Sea, 1974*, as amended.
- .36** Dangerous goods – cargoes which constitute additional fire hazard. Division of dangerous goods into classes is given in 2.10.1.9.

Note: For details relating to particular dangerous goods, see the *IMDG Code*.

- .37** Store-rooms – spaces such as:
- rooms for explosives, intended for the storage of materials of explosive nature, such as, e.g. pyrotechnic means of signalling;
  - rooms for readily ignitable materials, intended for the storage of flammable solids and flammable liquids, such as: paint and flammable liquids rooms, compressed flammable gas rooms, etc. ;
  - rooms for the storage of combustible materials, such as: boatswain’s stores, sail stores, carpenter shops, ship’s archives, luggage rooms, mail rooms, customs rooms, rooms for protective clothing and linen, laundries and drying rooms, kiosks and duty free shops;
  - rooms for the storage of non-combustible materials, such as: spare parts rooms, stores of mechanical and electrical workshops outside the machinery spaces.
- .38** Readily ignitable materials – solid materials capable of forming explosive dust-and-air mixtures, as well as any combustible dry, fibrous and other readily ignitable materials, such as cotton, tobacco, sulphur, etc.

**.39 Non-combustible material** – a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to 750 °C, this being determined in accordance with the *FTP Code*, Annex 1, Part 1. Any other material is a combustible material.

**.40 Steel equivalent material** – any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of applicable exposure to the standard fire test (e.g. aluminium alloy with appropriate insulation or composite material). Steel equivalent composite material is subject to test in accordance with IMO guidelines, specified in MSC/Circ.732.

**.41 Gross volume of a space** – the volume of the space without deduction for the arrangements, machinery, independent tanks, as well as equipment, contained therein.

**.42 Net volume of a space** – the volume of the space after deduction for the arrangements, machinery, independent tanks, as well as equipment, contained therein.

**.43 Person with reduced mobility** – anyone who has a particular difficulty when using public transport, including elderly persons, disabled persons, persons with sensory impairments and wheelchair users, pregnant women and persons accompanying small children.

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

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

**.46 Primary deck covering** – the first layer of a floor construction, applied directly on the top of the deck plating – primary coat, anticorrosive compound or adhesive – which is necessary to provide protection or the floor adhesion to the deck plating. Other layers in the floor construction are floor coverings.

**.47 Bulkhead deck** – the uppermost deck up to which the transverse watertight bulkheads are carried.

**.48 Weather (open) deck** – a deck which is completely exposed to the weather from above and from at least two sides.

**.49 Special category spaces** – enclosed spaces intended for the carriage of vehicles with fuel in their tanks for their own propulsion 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.

**.50 Cargo spaces** – all spaces used for cargo, including liquid fuel tanks, tanks for other liquid cargo and trunks to such spaces.

**.51 Accommodation spaces** – spaces such as public spaces, corridors, lavatories, crew and passenger cabins, offices, hospitals, cinemas, game and hobby rooms, barber shops, pantries containing no cooking appliances <sup>1)</sup> and other similar spaces.

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

**.53 Industrial spaces** – spaces, such as production spaces, workshops, laboratories, etc., in which readily ignitable materials (e.g. grease) or flammable liquids are produced, processed or used during manufacturing process.

**.54 Ro-ro spaces** – 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.

**.55 Vehicle spaces** – cargo spaces (e.g. conventional spaces) intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion.

**.56 Service spaces** – spaces used for galleys, pantries containing cooking appliances<sup>2)</sup>, lockers, mail and specie rooms, store-rooms, workshops other than

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<sup>1)</sup> Pantries or isolated pantries containing no cooking appliances may accommodate:

- toasters, microwave ovens, induction heaters and similar appliances each of them with a maximum power of 5 kW;
- electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of 2 kW and surface temperature not above 150 °C.

Such pantries may also contain coffee automats, dish washers and water boilers, with no uncovered hot surfaces, regardless of power.

A dining room containing such appliances shall not be regarded as a pantry.

<sup>2)</sup> Main pantries or isolated pantries provided with cooking appliances may contain:

- toasters, microwave ovens, induction heaters and similar appliances each of them with a maximum power of 5 kW;
- electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of 5 kW.

Such pantries may be also fitted with coffee automats, dish washers and water boilers, regardless of power.

Spaces containing any electrically heated cooking plate and hot plate for keeping food warm with a power of more than 5 kW shall be regarded as galleys.

those forming part of the machinery spaces, and similar spaces and trunks to such spaces.

**.57** Rooms containing furniture and furnishings of restricted fire risk – those rooms (with regard to fire integrity of adjacent spaces on passenger ships) containing furniture and furnishings of restricted fire risk (such as cabins, public spaces, offices or other types of accommodation) in which:

- .1** case furniture such as desks, wardrobes, dressing tables, bureaux, dressers, is 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 having a mass of 0.8 kg/m<sup>2</sup>, this being determined in accordance with the *FTP Code*, Annex 1, Part 7;
- .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 satisfactory qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the *FTP Code*, Annex 1, Part 8;
- .7** bedding components have qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the *FTP Code*, Annex 1, Part 9.

**.58** Cargo pump-rooms – spaces in tankers where pumps for cargo handling systems, stripping systems and crude oil washing systems are installed.

**.59** Control stations – those spaces, in which the ship's radio or main navigating equipment (such as: the steering stand<sup>1)</sup>, the compass, radar and direction-finding equipment) or the emergency source of power (including emergency batteries<sup>2)</sup>) 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 considered to be a fire control station.

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<sup>1)</sup> Steering gear room containing an emergency steering position is not considered to be control station.

<sup>2)</sup> Emergency batteries, regardless of battery capacity, for power supply from black-out till start of emergency generator, emergency batteries used as reserve source of energy to radiotelegraph installation, batteries for start of emergency generator or batteries regarded as emergency source of power, required in Chapter 9, *Part IX – Electrical Installations and Control Systems*.

**.60 Potential ignition sources** – sources having enough energy to cause ignition. These include high temperature surfaces, sparks or flames from inefficient flanges or joints, electrical discharges caused from electrostatic atmospheres, or electrical contactor faults. Sources of these are, for example, exhaust gas piping of internal combustion engines, leakages from boiler furnace joints and electrical equipment within oil treatment rooms.

**.61 Hot surfaces** – surfaces with a temperature of less than 220 °C including steam systems with a pressure of less than 2.3 MPa, thermal oil systems, exhaust gas piping and oil-fired boilers and exhaust gas boilers.

**.62 Heated surfaces** – surfaces with a high temperature source on the other side.

**.63 High temperature surfaces** – surfaces with temperatures above 220 °C.

**.64 Machinery spaces** – 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.

**.65 Machinery spaces of category A** – spaces and trunks to such spaces which contain:

- .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;
- .3** any oil-fired boilers or oil fuel units;
- .4** inert gas generators, incinerators, etc.

**.66 A Class divisions** – fire-resisting divisions formed by bulkheads and decks which comply with the following criteria:

- .1** they are constructed of steel or other equivalent material;
- .2** they are suitably stiffened;
- .3** they are insulated with approved non-combustible materials<sup>1)</sup>, <sup>2)</sup> 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 at least the time listed below:  
Class A-60 – 60 min,  
Class A-30 – 30 min,  
Class A-15 – 15 min,  
Class A-0 – 0 min,

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<sup>1)</sup> Adhesives used in the construction of divisions need not be non-combustible; however, they shall have low flame-spread characteristics.

<sup>2)</sup> For the construction of ship divisions – see para. 2.2.1.1.1.

- .4 they are so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test;
  - .5 a prototype bulkhead or deck has been satisfactorily tested in accordance with the *FTP Code* requirements, Annex 1, Part 3.
- .67 B Class divisions** – fire-retardant divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:
- .1 they are constructed of approved non-combustible materials<sup>1)</sup> and all materials used in the construction and erection of these divisions are non-combustible, with the exception that paint coatings and veneers with LFS characteristics may be used;
  - .2 they have an insulation value such that the average temperature of the unexposed side will not rise more than 140 °C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225 °C above the original temperature, within at least the time listed below:  
Class B-15 – 15 min,  
Class B-0 – 0 min,
  - .3 they are so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test;
  - .4 a prototype division has been satisfactorily tested in accordance with the *FTP Code* requirements, Annex 1, Part 3.
- .68 C Class divisions** – divisions constructed of approved non-combustible materials<sup>1)</sup>. They need to 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 all applicable requirements specified in the present *Part*.
- .69 Safe area in the context of a fire casualty** – from the perspective of habitability, any area (as regards the requirements for large passenger ships), which is not flooded or which is outside the main vertical zone(s) in which a fire has occurred such that it can safely accommodate all persons on board to protect them from hazards to life or health and provide them with basic services.
- .70 Cargo area** – part of the ship (as regards the requirements for tankers) 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<sup>2)</sup>.

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<sup>1)</sup> Adhesives used in the construction of divisions need not be non-combustible; however, they shall have low flame-spread characteristics.

<sup>2)</sup> Interpretations referring to the definition of cargo area with regard to void spaces or ballast water tanks protecting a fuel oil tank are given in MSC.1/Circ. 1239 for *SOLAS* regulations II-2/3.6 and II-2/4.5.1.1.

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

**.72 Fire-fighting equipment** – portable or mobile equipment used for extinction of fire, fire-fighting operations and personal protection, such as: fire hoses, nozzles, portable and mobile fire-extinguishers, portable foam applicator units, breathing apparatus and fire-fighter's outfit.

**.73 Standard fire test** – a test, with regard to fire structures, 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 *FTP Code*, Annex 1, Part 3.

**.74 Combination carrier** – a cargo ship designed to carry both oil and solid cargoes in bulk.

**.75 Passenger ship** – a ship which carries more than twelve passengers.

**.76 Ro-ro passenger ship** – a passenger ship with ro-ro spaces or special category spaces.

**.77 Cargo ship** – a ship intended for the carriage of cargoes, which is not a passenger ship.

**.78 Continuous B Class ceilings or linings** – those B Class ceilings or linings which terminate at an A or B Class division.

**.79 Flash-point** – the temperature in degrees Celsius (closed cup test) at which a product will give off enough flammable vapours to be ignited, as determined by an approved flash-point apparatus.

**.80 Helicopter facilities** – this term covers a helideck, helicopter landing area, refuelling and hangar facilities.

**.81 Low flame-spread** – with regard to materials used in structural fire protection low flame-spread means that the surface thus described will adequately restrict the spread of flame, this being determined in accordance with the *FTP Code*, Annex 1, Part 5.

**.82 Closed ro-ro spaces** – ro-ro cargo spaces which are neither open ro-ro spaces nor weather decks.

**.83 Closed vehicle spaces** – vehicle spaces which are neither open vehicle spaces nor weather decks.

**.84 Slop tank** – a tank (as regards the requirements for tankers) intended for the carriage of cargo tanks residues and washings.

**.85 Tanker** – for the purpose of *Part V*, tanker means a cargo ship constructed or adapted for the carriage in bulk of liquid cargoes of flammable nature.



**.86 Oil fuel unit** – the equipment used for the preparation and delivery of oil fuel, heated or not, to boilers (including inert gas generators) and internal combustion engines (including gas turbines) at a pressure of more than 0.18 MPa<sup>1)</sup>.

### **1.3 Scope of Survey**

**1.3.1** The general survey regulations for classification, construction surveys and surveys of ships during service within the scope of structural fire protection, fire-extinguishing systems, as well as fire detection and fire alarm systems are given in *Part I – Classification Regulations*.

**1.3.2** The following are subject to survey during ship construction or alteration: structural fire protection, fire-extinguishing systems, fire detection and fire alarm systems, other fire protection systems and arrangements, the documentation of which is subject to consideration and approval, as well as appliances and systems which constitute fire risk.

**1.3.3** For ships of 500 gross tonnage and upwards, as well as for all passenger ships engaged on international voyages (subject to *Convention SOLAS 74/78*, as amended) and flying the flag of EU Member State, the following components of fire-protection equipment/arrangements are subject to certification for compliance with *Council Directive 96/98/EC on Marine Equipment (MED)* of 20 December 1996, as amended, also referred to as *Directive MED*:

- .1** A and B Class divisions;
- .2** fire doors;
- .3** fire door control systems components;
- .4** A and B Class windows and side scuttles;
- .5** non-combustible materials;
- .6** primary deck coverings;
- .7** walls and ceilings surface materials and floor coverings with low flame-spread characteristics: decorative veneers, paint systems, floor coverings, as well as pipe insulation covers, adhesives used in A, B and C Class divisions and ventilation ducts combustibile covers;
- .8** draperies, curtains and other suspended textile materials and films (used in passenger ships);
- .9** upholstered furniture (used in passenger ships);
- .10** bedding components (used in passenger ships);
- .11** fire (ventilation) dampers;
- .12** penetrations through A Class divisions: electric cable transits, pipes, ducts, etc. penetrations;
- .13** penetrations through B Class divisions: electric cable transits, pipes, ducts, etc. penetrations;

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<sup>1)</sup> Oil fuel transfer pumps are not considered as oil fuel units.

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- .14 materials other than steel for pipes conveying oil or fuel oil: pipes, fittings, valves and flexible pipe assemblies;
  - .15 automatic sprinkler systems heads;
  - .16 equivalent high-pressure sprinkler systems heads;
  - .17 nozzles of fixed water-spraying systems and equivalent high-pressure water-based systems for use in machinery spaces and cargo pump-rooms;
  - .18 nozzles for equivalent high-pressure spraying water-based systems for use in ro-ro spaces and special category spaces;
  - .19 nozzles for fixed local spraying water-based systems for use in machinery spaces of category A;
  - .20 deep-fat cooking equipment fire-extinguishing systems nozzles (automatic or manual type);
  - .21 nozzles for fixed water-spraying systems for cabin balconies (used in passenger ships);
  - .22 components of equivalent fixed gas fire-extinguishing systems for use in machinery spaces and cargo pump-rooms (fire-extinguishing medium, main valves and discharge nozzles);
  - .23 aerosol systems equivalent to fixed gas fire-extinguishing systems for use in machinery spaces;
  - .24 components of fixed deck medium-expansion foam fire-extinguishing system (used in tankers);
  - .25 components of fixed low-expansion foam fire-extinguishing system used in machinery spaces and fixed deck foam fire-extinguishing system used in tankers;
  - .26 foam concentrates for fixed high-expansion foam fire-extinguishing systems for use in machinery spaces and cargo pump-rooms;
  - .27 foam concentrates for fixed foam fire-extinguishing systems for use in chemical carriers;
  - .28 fixed inside air foam systems for use in machinery spaces and cargo pump-rooms;
  - .29 arrangements to prevent the passage of flame into the cargo tanks in tankers;
  - .30 fixed oxygen analysis and flammable gas detection equipment (used in tankers);
  - .31 portable oxygen analysis and flammable gas detection equipment (used in tankers);
  - .32 inert gas systems components (used in tankers);
  - .33 components of escape routes low-location lighting systems (for use in passenger ships);
  - .34 fire hoses (classic) and fire hoses (reel type);
  - .35 dual-purpose type nozzles (spray and jet type);
  - .36 portable and mobile fire-extinguishers;
  - .37 portable fire-fighting equipment for lifeboats and rescue boats;

- .38 fire-fighter's outfit: protective clothing (close proximity clothing);
- .39 fire-fighter's outfit: boots;
- .40 fire-fighter's outfit: gloves;
- .41 fire-fighter's outfit: helmet;
- .42 fire-fighter's outfit: life-line;
- .43 self-contained compressed-air-operated breathing apparatus;
- .44 air-supplied breathing apparatus for use with a smoke helmet or smoke mask;
- .45 emergency escape breathing devices;
- .46 components of fixed fire detection and alarm systems for accommodation and service spaces, control stations, machinery spaces and unattended machinery spaces (control and indicating devices, electrical and electronic installations, power supply equipment, fire detectors: smoke detectors, heat detectors and flame detectors, as well as manually operated call points);
- .47 alarm devices of fire detection and alarm system.

Confirmation of compliance with the Directive requirements is Certificate of Conformity with *Directive MED*, issued by a notified body (the steering wheel mark on the Certificate).

**1.3.4** For ships of less than 500 gross tonnage and for passenger ships not engaged on international voyages, as well as for ships flying the flag of non-EU Member State, the fire-protection equipment/arrangements, specified in 1.3.3, shall be of the type approved by PRS (shall have *Type Approval Certificate* issued by PRS).

In lieu of *Type Approval Certificate*, the above-mentioned equipment may have Certificate of Conformity with *Directive MED*.

**1.3.5** The following structures, equipment/arrangements/materials used in fire protection, not covered by 1.3.3, shall be of the type approved by PRS:

- .1 C Class divisions;
- .2 carbon dioxide fire-extinguishing systems components: cylinders, distribution valves, flexible pipe assemblies, time-delay units, visual and audible warning devices, discharge nozzles;
- .3 fire-extinguishing systems components of paint lockers and flammable liquid lockers;
- .4 galley exhaust duct fixed fire-extinguishing systems components;
- .5 helicopter deck fire-extinguishing system components;
- .6 liquid gas fuel systems for domestic purposes (components);
- .7 nozzles for water spraying hand operated systems;
- .8 fixed dry chemical powder fire-extinguishing system used in gas tankers;
- .9 sample extraction smoke detection system components;
- .10 electric safety lamps;
- .11 chemical protective clothing;

- .12 portable foam applicator units;
- .13 cold-weather starting of generator sets (starting devices);
- .14 power-operated doors control system;
- .15 fire-extinguishing systems flexible couplings;
- .16 foam concentrate used in low-expansion foam fire-extinguishing system;
- .17 foam concentrate used in portable foam applicator units;
- .18 high-expansion foam generators;
- .19 fire hydrants;
- .20 low-location lighting system of escape routes;
- .21 alternative evacuation management system;
- .22 an automatic sprinkler system;
- .23 equivalent high-pressure automatic sprinkler system (water mist system);
- .24 water-spraying system for ro-ro and special category spaces;
- .25 equivalent high-pressure spraying water-based system for ro-ro and special category spaces;
- .26 water-spraying system for the protection of machinery spaces and cargo pump-rooms;
- .27 equivalent high-pressure spraying water-based system for machinery spaces and cargo pump-rooms;
- .28 fixed local water-based system for machinery spaces of category A;
- .29 water-spraying system and water-based system for cabin balconies;
- .30 equivalent gas fire-extinguishing system for machinery spaces and cargo pump-rooms;
- .31 high-expansion foam fire-extinguishing system;
- .32 fire detection and alarm system;
- .33 fire detection and alarm system for cabin balconies;
- .34 sample extraction smoke detection system;
- .35 hydrocarbon gas detection system;
- .36 liquid gas fuel systems for domestic purposes;
- .37 plastic pipes used in fire-extinguishing systems.

**1.3.6** PRS may give consent to a single acceptance of a structure, material or system, for which type approval is required, to be installed on a given ship subject to tests and acceptance surveys being carried out in accordance with the previously agreed tests and acceptance programme and the issue of Inspection Certificate/Certificate.

**1.3.7** Fire pumps, water-spraying systems supply pumps, water and foam pumps of foam fire-extinguishing systems are subject to acceptance and operation tests at the manufacturer's in the presence of PRS' Surveyor.

**1.3.8** Containers and pressure vessels of gas fire-extinguishing systems, as well as CO<sub>2</sub> manifold are subject to acceptance and pressure tests at the manufacturer's in the presence of PRS' Surveyor.

**1.3.9** During the ship service, fire-extinguishing systems and equipment used in fire protection, as well as appliances and equipment which constitute additional fire hazard are subject to periodical inspections and attestation in accordance with *Publication No. 29/P – Guidelines for Periodical Inspections of Fire-extinguishing Systems and Appliances Used on Ships*.

**1.3.10** Inspections, maintenance and repair of fixed fire-extinguishing systems, fire-fighting equipment (fire-extinguishers and portable foam applicator units), breathing apparatus, low-location lighting systems using photoluminescent materials, as well as laboratory tests of foam concentrates shall be carried out by service stations approved by PRS.

**1.3.11** Service stations seeking PRS' approval shall comply with the requirements specified in *Publication No. 51/P – Procedural Requirements for Service Suppliers*.

**1.3.12** Repairs of fixed fire-extinguishing systems on board are subject to acceptance of PRS' Surveyor in accordance with MSC./Circ. 1070.

## **1.4 Technical Documentation of Fire Protection**

### **1.4.1 Classification Documentation**

Prior to the commencement of ship construction, the following technical documentation shall be submitted to the PRS Head Office for consideration and approval:

#### **A. Structural Fire Protection:**

- .1** plan of structural fire protection, indicating the applied fire protection method, the names of compartments and their fire hazards, covering:
  - the arrangement of A, B and C fire divisions, taking into account closures of openings in these divisions;
  - the arrangement of draught stops;
  - designation of escape routes;
  - design of typical penetrations of pipings, cables and ventilation ducts through fire divisions;
- .2** fire doors arrangement and control plans;
- .3** plan of windows and sidescuttles;
- .4** plan of ship's spaces insulation;
- .5** plan of deck covering;
- .6** plans of ship equipment, covering:
  - linings and ceilings;
  - plan of floor lining;
  - list of upholstered furniture, mattresses, suspended textile materials and the bedding components (for passenger ships);

- .7 plan of maintenance and painting;
- .8 calculations of the total amount of combustible materials used in accommodation spaces, service spaces and control stations;
- .9 plan of ventilation and air-conditioning, including the arrangement of ventilation ducts, air inlets and outlets, as well as fire dampers;
- .10 plan of means of escape and escape time assessment (applicable to passenger ships only);
- .11 plan of low-location lighting and designation of escape routes (for passenger ships);
- .12 analysis of evacuation procedure (for ro-ro passenger ships);
- .13 the arrangement of safety centre (for passenger ships);
- .14 documentation confirming compliance with the requirements for large passenger ships in the context of fire disasters;
- .15 list of required certificates for materials/components/structures used in fire divisions.

#### **B. Active Fire Protection:**

- .1 water fire main system, including calculation of fire pump capacities, hydraulic calculations of the required pressure at fire hydrants, the arrangement of fire pumps, pipelines and fire hydrants;
- .2 automatic sprinkler system or equivalent high-pressure sprinkler system, including the calculations of the necessary water supply, the required pressure at sprinklers, diagram of the system operation, including alarm signals, drawing of pressure tank, the arrangement of pumps, pressure tank, section valves and sprinklers, with division into pipe sections;
- .3 water-spraying fire-extinguishing system or equivalent high-pressure water-spraying system for cargo spaces, including the calculations of pumps capacities, hydraulic calculations of the required pressure at spraying nozzles, the arrangement of pumps, pipelines and nozzles, with division into pipe sections;
- .4 water-spraying fire-extinguishing system or equivalent high-pressure water-spraying system for machinery spaces and cargo pump-rooms, including the calculations of pumps capacities, hydraulic calculations of the required pressure at spraying nozzles, the arrangement of pumps, pipelines and nozzles, with division into pipe sections;
- .5 local water-spraying fire-extinguishing system for machinery spaces of category A, including the calculations of pumps capacities, hydraulic calculations of the required pressure at spraying nozzles, diagram of the system operation, including alarm signals, the arrangement of pumps, pipelines and nozzles, with division into pipe sections;
- .6 local water-spraying fire-extinguishing system for exhaust gases fired oil boilers, including the calculations of the necessary water supply, diagram of the system operation, including alarm signals, the arrangement of pipelines, fittings and nozzles, as well as sewage drainage;

- .7 water screen system, including the calculations of water supplies, the arrangement of pipelines, fire hydrants and nozzles;
- .8 fire-extinguishing system for the protection of galley exhaust duct and deep-fat cooking equipment;
- .9 foam fire-extinguishing system, including the calculations of the required quantity of foam concentrate, hydraulic calculations of pipe diameters, the system operation diagram, the arrangement of pipes and devices such as foam concentrate tanks, proportioners, foam monitors and foam generators;
- .10 carbon dioxide fire-extinguishing system or an equivalent gas fire-extinguishing system, including the calculations of the required quantity of extinguishing medium, the diameters of pipes and nozzles, diagram of the system operation, including warning signalization, the arrangement of fire-extinguishing station, starting arrangements, the arrangement of pipes and nozzles, operation manual;
- .11 dry powder fire-extinguishing system, including the calculations of fire-extinguishing medium and the powder carrier, diagram of the system operation, the arrangement of fire-extinguishing stations, fire control stations, pipes and fittings;
- .12 inert gas system (for tankers and chemical carriers), including the calculations of the system equipment capacity, covering: diagram of the details and arrangement of the gas generating plant, the arrangement of the system components, the pipes for the distribution of gas to tanks and cofferdams, electrical diagrams of control and monitoring the inert gas parameters, automation and alarms;
- .13 fire detection and alarm system, including electric circuits diagrams, division into sections, the arrangement of control panel, indicating units, detectors and manually operated call points;
- .14 sample extraction smoke detection system, including the location of smoke detection control panel, indicating units, pipes and smoke accumulators, electric circuits diagrams,
- .15 hydrocarbon gas detection system (required for tankers), including the location of gas measurement and analysis panel, pipes and smoke accumulators, as well as electric circuits diagrams;
- .16 the arrangement of fire-fighting equipment, i.e. portable and mobile fire-extinguishers, portable foam applicator units, fire-fighter's equipment and emergency escape breathing apparatus;
- .17 a list of the required certificates for the applied components, appliances, systems, fire-fighting equipment.

### **C. Appliances and Equipment Constituting Additional Fire Hazard**

- .1 helicopter facilities, fire-extinguishing systems and helideck equipment;
- .2 tanks and distributing stations for fuel with a flash-point below 43°C;
- .3 welding gases system; .

**.4** liquefied gas installation for domestic purposes.

Classification documentation shall contain material specifications, list of appliances, components of systems, as well as the necessary information allowing to assess whether structures/appliances/systems comply with the requirements of PRS Rules.

With regard to ships to be assigned additional mark in the symbol of class, additional documentation relating to structural fire protection, active fire protection or appliances and equipment which constitute fire hazard on ship may be required by PRS.

For ships undergoing alteration, the above-mentioned documentation is subject to consideration and approval within the scope regarding alteration.

### **1.4.2 Fire Control Plan**

**1.4.2.1** Ships of 150 gross tonnage and above, as well as all ships engaged on international voyages shall be provided with *Fire Control Plan*, based on the general arrangement plan, indicating:

- .1** the arrangement of A and B Class divisions, vertical and horizontal, as well as fire doors in these divisions;
- .2** control stations and fire control stations;
- .3** main and secondary escape routes (stairways, ladders, doors and manholes), as well as directions of escape routes from all areas and spaces on the ship to the open deck, to lifeboats and liferafts embarkation areas;
- .4** ship spaces/areas fitted with fire detection and fire alarm systems, as well as the arrangement of: fire and explosive gases detectors, manually operated call points and fire alarm control panel;
- .5** ship spaces/areas protected by fixed fire-extinguishing systems and the arrangement of: fire-extinguishing medium storage tanks, water and foam monitors, shut-off valves, fire hydrants, shore connections, as well as control and alarm devices;
- .6** the arrangement of fire-fighting equipment, i.e. fire-extinguishers, portable foam applicator units, fire-fighter's outfit, fire axes, emergency escape breathing devices, as well as chemical protective clothing and additional breathing apparatus required when dangerous goods are carried;
- .7** position of remote shutting off the ventilation system and the location of: fire dampers in ventilation ducts and ventilation openings closures in spaces protected by total flooding gas systems;
- .8** fuel and lubricating oil tanks, located outside the double bottom, the arrangement of remote control of shut-off valves and stopping oil fuel and lubricating oil pumps;
- .9** main and emergency fire and bilge pumps, emergency generating set and emergency switchboard;
- .10** fire alarm call points and equipment;



- .11 internal communication telephones;
- .12 inert gas systems appliances (for tankers);
- .13 the location of container, in which *Fire Control Plan*, intended for the shoreside fire-fighting personnel, is stored;
- .14 assembly stations for passengers and crew (for passenger ships);
- .15 list and the arrangement of numbered openings (doors, manholes, ventilation inlets) which shall be closed before the release of fire-extinguishing medium into spaces protected by total flooding system.

*Fire Control Plan* shall show the ship's profile with indicated deck levels, main fire divisions and main escape routes.

In specification table on the *Plan*, the number of the required fire-fighting equipment and other equipment used in fire protection shall be given.

A free space shall be left on the *Plan* for recording possible changes and information related to ship modifications.

**1.4.2.2** The graphic symbols used in *Fire Control Plan* shall conform to the symbols given in Res. A.952(23); all the descriptions shall be in the official language of the Flag State. The descriptions in *Fire Control Plans* intended for ships engaged on international voyages shall be also in English.

In *Fire Control Plans* intended for existing ships constructed before 1 January 2004, the graphic symbols set out in Resolution A.654(16), may be used.

**1.4.2.3** *Fire Control Plan* shall be exhibited in the ship in the visible places – in halls, mess rooms, as well as on the navigation bridge and at control station.

**1.4.2.4** Alternatively, the information included in *Fire Control Plan* may be presented in the form of a booklet, which shall be at all times available on board in an easily accessible position. One copy of the booklet shall be kept by each officer.

**1.4.2.5** A duplicate of *Fire Control Plan*, intended for use by the shoreside fire-fighting personnel, shall be permanently stored in a container at entrances, outside the deckhouse, on each side of the ship. The container shall be weathertight, painted red and marked in accordance with the guidelines, specified in MSC/Circ.451.

The location of each container with *Fire Control Plan* shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**1.4.2.6** *Fire Control Plan* shall be subject to updating and any changes to the *Plan* shall be recorded, on a routine basis, by the officer responsible for fire protection.

**1.4.2.7** *Fire Control Plan* shall be approved by the Flag State Maritime Administration or PRS, acting on behalf of the Flag State Maritime Administration.

**1.4.2.8** *Fire control plan* shall be marked with ship identification number which conforms to the IMO ship identification scheme adopted by the Organization, in accordance with *SOLAS Convention*, reg. XI-1/3.

### **1.4.3 Maintenance and Safety Operation Documentation**

**1.4.3.1** The ship shall be provided with the following documentation:

- .1** *Fire protection systems and appliances maintenance plan*;
- .2** *Fire training manual*;
- .3** *Fire safety operational booklet*.

The above documentation shall be marked with IMO ship identification number.

**1.4.3.2** *Fire protection systems and appliances maintenance plan* shall contain information on maintenance, testing and inspections of fire-extinguishing systems, appliances and equipment, carried out by the crew, covering:

- .1** water fire-extinguishing systems, fire pumps and fire hydrants, including fire hoses, nozzles and international shore connections;
- .2** all other fixed fire-extinguishing systems;
- .3** fire detection and fire alarm systems, as well as warning signalization;
- .4** automatic sprinkler 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** fire-extinguishers, including spare charges; and
- .11** fire-fighter's outfit.

*Maintenance plan* may be computer-based.

For passenger ships, *Maintenance plan* shall additionally cover low-location lighting of escape routes and public address system.

For tankers, *Maintenance plan* shall additionally cover the inert gas system, the deck foam system, fire safety arrangements in cargo pump-room, hydrocarbon gas detection systems and flammable gas detectors.

In ships to be assigned an additional mark in the symbol of class, the *Maintenance plan* shall additionally cover special fire-fighting equipment required for the relevant ship.

*Maintenance plan* shall also take into account the guidelines specified in MSC/Circ. 850.

**1.4.3.3** *Training manual* shall include instructions for fire emergency proceedings, as well as conducting training and fire drills, within the following scope:

- .1** general fire safety practice and precautions related to the dangers of smoking, electrical hazards, flammable liquids and similar common shipboard hazards;

- .2 general instructions for fire-fighting activities and fire-fighting procedures, including procedures for notification of a fire and use of manually operated call points;
- .3 fire-fighting procedures and the duties assigned to particular crew members;
- .4 division of crew members into parties responsible for rescue and fire-fighting operations;
- .5 meaning of the ship's alarms;
- .6 operation and use of fire-extinguishing systems and appliances;
- .7 operation and use of fire doors;
- .8 operation and use of fire dampers and smoke dampers;
- .9 evacuation systems and equipment.

The *Training manual* shall be written in the working language of the ship and shall be provided in each crew mess room and recreation room or in each crew cabin.

The *Training manual* may be prepared in the audio-visual form.

**1.4.3.4** The *Fire safety operational booklet* shall contain the necessary information and instructions for the safe operation of the ship and cargo handling operations in relation to fire safety.

The *Fire safety operational booklet* shall include information concerning the crew duties and responsibilities for the general fire safety of the ship while loading and discharging cargo and while underway.

Necessary fire safety precautions for handling different cargoes, such as: containers, general cargoes, etc. shall be explained therein.

In the case of ships carrying dangerous cargoes and flammable bulk cargoes, the *Fire safety operational booklet* shall also provide reference to the pertinent fire-fighting and emergency cargo handling instructions contained in the *Code of Safe Practice for Solid Bulk Cargoes (BC Code)*, the *International Bulk Chemical Code (IBC Code)*, the *International Gas Carrier Code (IGC Code)* and the *International Maritime Dangerous Goods Code (IMDG Code)*.

The *Fire safety operational booklet* shall be provided in each crew mess room and recreation room or in each crew cabin.

The *Fire safety operational booklet* shall be written in the working language of the ship.

The *Fire safety operational booklet* may be combined with *Training manual*.

For tankers, the *Fire safety operational booklet* shall include provisions for preventing fire spread to the cargo area due to ignition of flammable gases or flammable vapours, as well as procedures for cargo tank gas-purging and gas-freeing.

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## **2 FIRE PROTECTION OF CARGO SHIPS**

### **2.1 Ship Construction**

#### **2.1.1 Materials for Hull, Superstructures, Structural Bulkheads, Decks and Deckhouses**

The hull, superstructures, structural bulkheads, decks and deckhouses shall be constructed of steel or steel equivalent material.

For the purpose of applying the definition of “steel equivalent material”, as specified in 1.2.40, the applicable fire exposure shall be according to the integrity and insulation standards given in the appropriate tables relating to fire divisions. For example, where divisions such as decks or sides and ends of deckhouses are permitted to have B-0 fire integrity, the applicable fire exposure shall be half an hour.

#### **2.1.2 Materials for Outfitting the Ships**

##### **2.1.2.1 Use of Non-Combustible Materials**

###### **2.1.2.1.1 Insulating Materials and Structure Elements**

Materials used for the insulation of walls, floors and ceilings, as well as the insulation of pipings and ventilation ducts penetrating the ship spaces shall be non-combustible, except in cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces.

Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings for cold service systems (refrigeration systems and chilled water piping for air-conditioning systems) need not be of non-combustible materials, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame-spread characteristics.

In spaces where petrol products may be present, the insulation surface shall be impenetrable for these products and their vapours. The fire insulation in such spaces can be covered by metal sheets (not perforated) or by vapour barrier glass cloth accurately sealed at the joint.

Insulation materials, as well as structural materials with insulation containing asbestos are prohibited, see MSC.1/Circ. 1374.

Insulation materials and structural materials with insulation, such as wall, ceiling and floor coverings, fire doors, etc. shall be supplied with asbestos-free declaration.

###### **2.1.2.1.2 Ceilings and Linings**

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

- .1** in accommodation spaces, service spaces and control stations in ships where *method IC*, specified in 2.2.3.1, has been adopted; and

- .2 in corridors and stairway enclosures serving accommodation spaces, service spaces and control stations in ships where *method IIC* or *IIIC*, specified in 2.2.3.1, has been adopted.

## 2.1.2.2 Use of Combustible Materials

### 2.1.2.2.1 General Requirements

Non-combustible bulkheads, ceilings and linings fitted in accommodation spaces, service spaces and control stations may be faced with combustible materials, facings, mouldings, decorations and veneers, provided that such spaces are bounded by non-combustible bulkheads, ceilings and linings in accordance with the requirements specified in 2.1.2.2.2 to 2.1.2.2.4.

### 2.1.2.2.2 Maximum Heat of Combustion of Combustible Materials

Combustible materials used on the surfaces of bulkheads, ceilings and linings, specified in 2.1.2.2.1 and 6.1.1.2.2, shall have the heat of combustion  $Q$  not exceeding 45 MJ/m<sup>2</sup> of the area for the thickness used. This requirement is not applicable to the surfaces of furniture fixed to linings or bulkheads.

Heat of combustion of material shall be determined from the formula:

$$Q = Q_g q s, [\text{MJ/m}^2]$$

where:

$Q$  – heat of combustion for the thickness used, [MJ/m<sup>2</sup>];

$Q_g$  – material heat of combustion, determined according to *PN-EN ISO 1716: Reaction to fire tests for building products – Determination of the heat combustion*, [MJ/kg];

$q$  – material density, [kg/m<sup>3</sup>];

$s$  – material thickness, [m].

Materials used on the surfaces of bulkheads, ceilings and linings shall be provided with test certificate confirming the material heat of combustion, issued by an approved laboratory.

### 2.1.2.2.3 Total Volume of Combustible Materials

Where, in accordance with 2.1.2.2.1, on the surfaces of bulkheads, ceilings and linings combustible materials are used, the total volume of the materials shall be as follows:

- .1 the total volume of combustible facings, mouldings, decorations and veneers in accommodation and service spaces shall not exceed a volume equivalent to 2.5 mm veneer on the combined area of the bulkheads and ceilings linings. Furniture fixed to linings, bulkheads or decks need not be included in the calculation of the total volume of combustible materials;
- .2 in the case of ships fitted with automatic sprinkler system complying with the requirements of 3.3, the above volume may include some combustible materials used for erection of C Class divisions.

#### **2.1.2.2.4 Use of Materials on Exposed Surfaces<sup>1)</sup>**

The materials used for the following exposed surfaces shall have low flame-spread characteristics, confirmed by test in accordance with the *FTP Code*, Annex 1, Part 5:

- .1 exposed surfaces in corridors and stairway enclosures;
- .2 exposed surfaces of ceilings in accommodation spaces, service spaces (except saunas) and control stations;
- .3 surfaces and grounds in concealed and inaccessible spaces in accommodation and service spaces, as well as control stations.

In ships other than passenger ships, exposed surfaces in cabins, service spaces, public spaces and control stations need not have low flame-spread characteristics.

#### **2.1.2.2.5 Paints, Varnishes and other Finishing Materials**

Paints, varnishes and other finishing materials used on exposed<sup>1)</sup> interior surfaces within accommodation spaces, service spaces, control stations and stairway enclosures shall not be capable of producing excessive quantities of smoke and toxic products, this being determined in accordance with the *FTP Code*, Annex 1, Part 2.

#### **2.1.2.2.6 Primary Deck Coverings**

Primary deck coverings, if applied within accommodation spaces, service spaces and control stations, shall be made of approved materials which will not readily ignite, will not give rise to smoke or toxic or explosive hazards at elevated temperatures, this being determined in accordance with the *FTP Code*, Annex 1, Part 6.

#### **2.1.2.2.7 The Total Mass of Combustible Materials in Ship Spaces**

It is recommended, in accordance with guidelines specified in MSC. Circ. 1003, that in accommodation spaces, service spaces and control stations (excluding floor coverings), the total mass of combustible materials, such as: cable insulation, plastic pipes, veneers, outfitting, as well as combustible materials used for furniture, bedding components and electrical appliances per unit area of the space shall not exceed the following values:

- 5 kg/m<sup>2</sup> – for corridors, stairways and control stations;
- 35 kg/m<sup>2</sup> – for accommodation spaces;
- 45 kg/m<sup>2</sup> – for service spaces surrounded by A Class divisions.

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<sup>1)</sup> The exposed surfaces are the surfaces of bulkheads, decks, floor coverings, bulkheads and ceilings linings. The requirements of this paragraph are not applicable to plastic pipes, electric cables and furniture.

### 2.1.2.3 Waste Receptacles

Waste receptacles shall be constructed of non-combustible materials, capable of being closed and shall have no openings in the sides or bottom.

The use of waste receptacles constructed of combustible materials in galleys, pantries, bars, garbage handling or storage spaces and incinerator rooms is not precluded, provided they are intended purely for the carriage of wet waste, glass bottles, metal cans and are suitably marked.

### 2.1.3 Structure of Aluminium Alloys

Where any part of the structure is made of aluminium alloy, the following requirements shall be complied with:

- .1 the insulation of aluminium alloy components of A or B Class divisions, except structure which is non-load-bearing<sup>1)</sup>, shall be such that the temperature of the structural core does not rise more than 200 °C above the ambient temperature at any time during the applicable fire exposure to the standard fire test;
- .2 special attention shall be given to the insulation of aluminium alloy components of columns, stanchions and other structural members required to support lifeboat and liferaft stowage, launching and embarkation areas, as well as A and B Class divisions to ensure:
  - .1 that for such members supporting lifeboat and liferaft areas and A Class divisions, the temperature rise limitation, specified in subparagraph .1 shall apply at the end of one hour; and
  - .2 that for such members required to support B Class divisions, the temperature rise limitation, specified in subparagraph .1 shall apply at the end of half an hour.

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<sup>1)</sup> Load-bearing division is a deck or bulkhead including stiffeners, pillars, stanchions and other structural members which, if eliminated, would adversely affect the designated structural strength of the ship.

If an aluminium deck is tested with insulation installed below the deck, then the result will apply to decks, which are bare on the top. Aluminium decks may not be provided with deck coverings on the top unless tested with the deck covering, to verify that the 200°C temperature of the aluminium is not exceeded. However, when needed, any approved primary deck covering (not specifically the one used during the standard fire test of the deck) may be used for meeting this requirement.

When spaces of categories (1) to (10) – according to 6.1.4 and of categories (1) to (5) and (10) – according to 6.1.5 are located on top of aluminium decks, the deck does not need to be insulated from the upper side, provided the deck is protected by an approved primary deck covering.

## **2.1.4 Machinery Spaces of Category A**

### **2.1.4.1 General Requirements**

**2.1.4.1.1** Machinery spaces of category A shall be enclosed by steel A Class bulkheads and decks having the fire integrity as required for fire divisions separating the relevant adjacent spaces.

**2.1.4.1.2** The crowns and casings of machinery spaces of category A shall be of steel construction having the fire integrity as required for such machinery space.

**2.1.4.1.3** The floor plating of normal passageways in machinery spaces of category A shall be made of steel.

**2.1.4.1.4** Materials used for floors, lining of bulkheads, ceilings or decks in machinery spaces and engine control rooms shall be non-combustible. Where there is a danger that oil may penetrate insulating materials, these shall be protected against the penetration of oil or oil vapours.

**2.1.4.1.5** Where oil-fired boilers are located in machinery spaces on 'tweendecks and boiler rooms are not separated from the machinery space by A Class divisions, the 'tweendeck shall be provided with steel tight coamings at least 0.2 m in height.

**2.1.4.1.6** To prevent fires in machinery spaces, the guidelines given in MSC.1/Circ.1321 shall be taken into account in the design, assembly and maintenance of machinery installations and equipment.

### **2.1.4.2 Protection of Openings in Boundary Bulkheads in Machinery Spaces of Category A**

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

**2.1.4.2.2** Skylights in machinery casings shall be made of steel and shall not contain glass panels.

**2.1.4.2.3** Glazed windows shall not be fitted in machinery space boundaries. However, glazed windows may be fitted in engine control rooms within the machinery space.

**2.1.4.2.4** Doors fitted in boundary bulkheads of machinery spaces of category A shall be reasonably gastight and self-closing.



### 2.1.4.3 Means of Control in Machinery Spaces of Category A

2.1.4.3.1 Means of control shall be provided for:

- .1 opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation and closure of ventilator dampers;
- .2 stopping ventilating fans of machinery space ventilation system;
- .3 stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service pumps, thermal oil circulating pumps and oil separators;
- .4 closing oil fuel pipes valves for storage, settling and daily service tanks situated in machinery space above the double bottom;
- .5 closing power-operated doors or the doors fitted with release mechanism, which are not watertight power-operated doors.

2.1.4.3.2 Means of control, required above, shall be located outside the machinery spaces, where they will not be cut off in the event of fire in the spaces they serve, with due regard to hot gases produced by a fire in the space concerned.

2.1.4.3.3 The location of means of control in machinery spaces of category A shall be indicated by a plate with the symbol used on *Fire Control Plan*.

### 2.1.4.4 Fan Rooms Serving Machinery Spaces

2.1.4.4.1 A fan room solely serving the machinery space or multiple spaces containing machinery space may be treated as machinery space having little or no fire risk. In this case:

- .1 vertical and horizontal boundaries between the fan room and the machinery space casing shall have A-0 fire integrity;
- .2 ducts penetrations shall comply with the requirements specified in paragraph 11.2.6, *Part VI – Machinery Installations and Refrigerating Plants*;
- .3 ducts serving the machinery space shall be routed directly to the relevant fan(s) and from the fans to the louvres;
- .4 closing of the ventilation duct to/from the machinery space should be possible from outside the machinery space. In such case, the controls for the closing of the machinery space ventilation duct (i.e. fire dampers installed in accordance with the requirements stated in 11.2.6.2, *Part VI – Machinery Installations and Refrigerating Plants*) can be located inside the fan room.

2.1.4.4.2 A fan room solely serving the machinery space may be considered a part of the machinery space. In such case:

- .1 the requirements for fire integrity of horizontal boundaries between the fan room and the machinery space do not apply;
- .2 closing the ventilation duct to/from the machinery space shall be possible from outside the machinery space. In this case, the controls for closing the

ventilation duct (i.e. a fire damper installed in accordance with the requirements specified in paragraph 11.2.6.2, *Part VI – Machinery Installations and Refrigerating Plants*) shall be located outside the fan room.

**2.1.4.4.3** For both cases described above, for any space(s) adjacent to the fan room superstructure, the fire integrity of the separating bulkheads shall comply with the applicable requirements set forth in 2.2.2.

### **2.1.5 Store-Rooms for Paints and Flammable Liquids**

Store-rooms for paints and flammable liquids shall be classified as spaces of category (9) – service spaces of high fire risk. Walls and decks enclosing such store-rooms shall be A Class steel divisions, having the fire integrity as required for fire divisions adjacent to the relevant spaces.

Exits from the store-rooms shall lead directly to the open deck or via corridor and stairway designed for the purpose.

### **2.1.6 Welding Shops**

Welding shops located outside machinery spaces shall be classified as spaces of category (9) – service spaces of high fire risk. Walls and decks enclosing such welding shops shall be A Class steel divisions, having the fire integrity as required for fire divisions separating adjacent spaces.

Exit from the welding shop shall lead directly to the open deck.

Welding shops located within machinery spaces shall be situated at a distance of not less than 5 m from fuel and oil tanks and from the spaces of fuel treatment (e.g. fuel separators). They shall be enclosed by A-0 Class divisions, the deck within the welding shop being of A-60 Class standard.

### **2.1.7 Saunas**

Construction and arrangement of saunas shall comply with requirements specified in 6.1.1.7. The boundaries separating the sauna from other spaces except those inside of the perimeter and spaces of categories (5), (7) and (10), specified in 2.2.2.2, shall be insulated to A-60 Class standard.

### **2.1.8 Galleys**

**2.1.8.1** The walls and decks enclosing galleys shall be of A Class standard, with fire integrity as required for service spaces of high fire risk, in accordance with Tables given in 2.2.2 for divisions separating the relevant adjacent spaces. The entrance doors shall be self-closing.

**2.1.8.2** Floors, wall linings and suspended ceilings shall be made of non-combustible materials.

## **2.2 Fire Divisions**

### **2.2.1 Fire Division Construction**

#### **2.2.1.1 Class A, B and C Fire Divisions**

**2.2.1.1.1** Insulated A Class bulkheads and decks used on board ships, including means of affixing the insulation to the A Class structural members, shall be consistent with the materials, details and arrangements used during fire tests, conducted during type approval tests of the given division. The fire test report shall contain information given in Annex to MSC.1/Circ.1435.

**2.2.1.1.2** A division consisting of a non-combustible core and combustible veneer may be accepted as B or C Class division after it has undergone the following tests:

- .1** core non-combustibility test in accordance with the *FTP Code*, Annex 1, Part 1;
- .2** smoke and toxic products test of the veneer in accordance with the *FTP Code*, Annex 1, Part 2;
- .3** surface flammability test of the veneer in accordance with the *FTP Code*, Annex 1, Part 5.

To be accepted as B Class division, the above-mentioned division shall additionally undergo the test required for B Class divisions, specified in the *FTP Code*, Annex 1, Part 3.

**2.2.1.1.3** Light weight constructions (honeycomb type) made of steel or equivalent material may be used as non-load bearing internal A Class divisions in accommodation and service spaces, provided they have successfully passed the relevant standard fire test according to the *FTP Code*, Annex 1, Part 3.

#### **2.2.1.2 Draught Stops**

**2.2.1.2.1** Draught stops are tight barriers aimed at preventing the spread of smoke and fire, as well as preventing a draught of air containing oxygen from sustaining a fire in areas behind ceilings, panellings or linings where this cannot readily be seen.

**2.2.1.2.2** Air spaces behind ceilings, panellings or linings in accommodation spaces, service spaces, control stations and corridors shall be divided by draught stops spaced not more than 14 m.

**2.2.1.2.3** In the vertical direction, such air spaces, including those behind linings of stairways and lift trunks, shall be closed by draught stops at each deck.

**2.2.1.2.4** To construct draught stops, the following methods may be applied:

- .1** the extension of B or C Class bulkhead, ceiling or lining;

- .2 steel sheet not less than 1 mm in thickness, stiffened, intermittently welded to the ship's structure and the top profile of the bulkhead or fastened mechanically to the ceilings or linings;
- .3 non-combustible board, fastened mechanically to the ship's structure, bulkheads, ceilings or linings;
- .4 A Class mineral wool insulation, not less than 20 mm in thickness, faced on each side with expanded metal mesh, the mesh on one side being attached to the ship's structure, or expanded metal mesh being fitted on one side and non-combustible cloth (glass-cloth) on the other side of mineral wool insulation.

Other equivalent arrangements may be accepted.

**2.2.1.2.5** Where continuous ceilings are used, the draught stops shall be in line with the bulkheads.

**2.2.1.2.6** Draught stops are not required in public spaces with open ceilings (perforated ceilings) with openings of 40% or more and arranged in such a way that a fire behind the ceiling can be seen and easily extinguished.

## **2.2.2 Fire Integrity of Bulkheads and Decks**

**2.2.2.1** The minimum fire integrity of vertical divisions (walls, bulkheads) separating adjacent spaces shall be in accordance with Table 2.2.2-1. The minimum fire integrity of bulkheads forming horizontal divisions (decks) shall be in accordance with Table 2.2.2-2.

**2.2.2.2** The following requirements shall govern the application of the Tables:

- .1 where only one value is given for fire integrity standards of a division between two spaces, this value shall be used for all cases;
- .2 the dash means that there are no restrictions as far as material and fire integrity of a given division are concerned;
- .3 for determining the appropriate fire integrity standards to be applied, the spaces are classified according to their fire risk. Where there exists doubt as to classification of space to one of the below-given categories, it shall be treated as a space within the relevant category having the most stringent boundary requirements. The title of each category is intended to be typical rather than restrictive;
- .4 smaller, enclosed rooms within a space that have less than 30% communicating openings to that space are considered separate spaces. The fire integrity standard of the boundary bulkheads and decks of such smaller rooms shall be as prescribed in Tables 2.2.2-1 and 2.2.2-2.

11 categories are provided:

### **(1) Control stations:**

- spaces containing emergency sources of power and lighting (spaces containing accumulator batteries, emergency generating sets compartments);
- wheelhouse and chartroom, radar transmitter room;

- spaces containing the ship's radio equipment;
  - fire control stations;
  - control rooms for propulsion machinery when located outside the propulsion machinery space;
  - spaces containing centralized fire alarm equipment.
- (2) **Corridors** – corridors and lobbies.
- (3) **Accommodation spaces** – see the definition given in 1.2.51, excluding corridors.
- (4) **Stairways** – interior stairways, lifts, totally enclosed emergency escape trunks and escalators (except those wholly contained within the machinery spaces) and enclosures thereto. A stairway which is enclosed at one level only shall be regarded as part of the space from which it is not separated by a fire door.
- (5) **Service spaces of minor fire risk:**
- lockers and store-rooms having a deck area less than 4 m<sup>2</sup>, not having provisions for the storage of flammable liquids, as well as drying rooms and laundries;
  - identifiable spaces containing distribution boards, having a deck area of less than 4 m<sup>2</sup>;
  - refrigerated provision chambers if thermally insulated with non-combustible material.
- (6) **Machinery spaces of category A** – see the definitions given in 1.2.65.
- (7) **Other machinery spaces:**
- machinery spaces, specified in 1.2.64, excluding machinery spaces of category A;
  - electrical equipment rooms (e.g. auto-telephone exchange, air-conditioning duct spaces).
- (8) **Cargo spaces** – all spaces used for cargo (including cargo oil tanks) and trunk ways and hatchways to such spaces.
- (9) **Service spaces (high fire risk)** – galleys, pantries containing cooking appliances, paint and readily ignitable materials rooms, lockers and store-rooms having areas of 4 m<sup>2</sup> or more, store-rooms for flammable liquids, saunas, workshops other than those forming part of the machinery spaces, as well as spaces for the storage and processing of garbage, as well as refrigerated provision chambers if insulated with combustible material.
- (10) **Open decks:**
- open deck spaces and enclosed promenades clear of lifeboat and liferaft embarkation and lowering stations. To be considered in this category, enclosed promenades shall have no significant fire risk, meaning that furnishings shall be restricted to deck furniture. In addition, such spaces shall be naturally ventilated by permanent openings;
  - air spaces (the spaces outside superstructures and deckhouses).
- (11) **Ro-ro spaces and vehicle spaces** – spaces defined in 1.2.54 and 1.2.55.

**Table 2.2.2-1**  
**Fire integrity of bulkheads separating adjacent spaces**

Spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	A-0 <sup>e)</sup>	A-0	A-60	A-0	A-15	A-60	A-15	A-60	A-60	*	A-60
Corridors and lobbies		C	B-0	B-0 A-0 <sup>c)</sup>	B-0	A-60	A-0	A-0	A-0	*	A-30
Accommodation spaces (3)			C <sup>a),b)</sup>	B-0 A-0 <sup>c)</sup>	B-0	A-60	A-0	A-0	A-0	*	A-30
Stairways (4)				B-0 A-0 <sup>c)</sup>	B-0 A-0 <sup>c)</sup>	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 <sup>g)</sup>	A-60	*	A-0 <sup>f)</sup>
Other machinery spaces (7)							A-0 <sup>d)</sup>	A-0	A-0	*	A-0
Cargo spaces/ conventional cargo holds (8)								*	A-0	*	A-0
Service spaces (high risk) (9)									A-0 <sup>d)</sup>	*	A-30
Open decks (10)										–	A-0
Ro-ro and vehicle spaces (11)											* <sup>h)</sup>

**Table 2.2.2-2**  
**Fire integrity of decks separating adjacent spaces**

Space below ↓	Space → above	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	(1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0	*	A-60
Corridors and lobbies (2)	(2)	A-0	*	*	A-0	*	A-60	A-0	A-0	A-0	*	A-30
Accommodation spaces (3)	(3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0	A-0	*	A-30
Stairways (4)	(4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0	A-0	*	A-30
Service spaces (low risk) (5)	(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)	(6)	A-60	A-60	A-60	A-60	A-60	*	A-60 <sup>i)</sup>	A-30	A-60	*	A-60
Other machinery spaces (7)	(7)	A-15	A-0	A-0	A-0	A-0	A-0	*	A-0	A-0	*	A-0

Space below ↓	Space→ above	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cargo spaces/ conventional cargo holds (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-0	A-0	*	A-0 <sup>d)</sup>	*	A-30
Open decks (10)		*	*	*	*	*	*	*	*	*	-	*
Ro-ro and vehicle spaces (11)		A-60	A-30	A-30	A-30	A-0	A-60	A-0	A-0	A-30	*	* <sup>h)</sup>

**Notes to Tables 2.2.2-1 and 2.2.2-2:**

- a) No special requirements are imposed upon bulkheads in *methods IIC and IIIC* of fire protection.
- b) In the case of *method IIIC*, B-0 Class bulkheads shall be provided between spaces or groups of spaces of 50 m<sup>2</sup> and over in area.
- c) For the choice of division type – see 2.2.3 and 2.2.4.
- d) Where spaces are of the same numerical category, 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 other galley does not require a bulkhead, but a galley next to a paint room requires A-0 bulkhead.
- e) Bulkheads separating the wheelhouse, chartroom and radio room from each other may be of B-0 rating.
- f) A-0 rating may be used only 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, the requirements of 2.10 apply.
- h) Bulkheads and decks separating ro-ro cargo spaces shall be capable of being closed reasonably gastight and such divisions shall have A Class integrity in so far as is reasonable and practicable.
- i) If the machinery space in category (7) has low fire risk, A-0 Class bulkheads may be used. To determine such space – see 6.1.4.2(10).
- \* 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 the electric cables, pipes and vent ducts, such penetrations shall be made tight to prevent the passage of flame and smoke. Divisions between control stations (emergency generators) and open deck may have air intake openings without means for closure, unless a fixed gas fire-extinguishing system is fitted.

**2.2.2.3** 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 fire integrity of a division.

**2.2.2.4** External boundaries of superstructures and deckhouses which are required in 2.1.1 to be of steel or other equivalent material may be pierced for the fitting of windows and sidescuttles other than of A Class, provided that in this Part of the *Rules* there is no requirement for such boundaries to have A Class fire integrity. Similarly, such boundaries may be fitted with doors other than A Class doors made of materials other than steel, type approved.

**2.2.2.5** The use of fire division with fire integrity higher than the division with fire integrity required by the *Rules* in the range of the same type of division, e.g. Class B-15 division instead of Class B-0, Class A-15 division instead of Class A-0, etc. is permitted.

### **2.2.3 Divisions within Accommodation Spaces, Service Spaces and Control Stations**

**2.2.3.1** One of the following methods of fire protection shall be adopted in accommodation spaces, service spaces and control stations:

- method IC – all internal divisional bulkheads shall be made as B or C Class divisions; accommodation and service spaces are not required to be fitted with automatic sprinkler system and fire detection and fire alarm system, except that smoke detectors shall be provided in corridors, stairways and escape routes, in compliance with 2.4.1.1.1;
- method IIC – all spaces in which fire might be expected to originate shall be fitted with automatic sprinkler system in compliance with 2.4.1.1.2, with no restriction on the type of internal divisional bulkheads;
- method IIIC – the fitting of fire detection and fire alarm system, in compliance with 2.4.1.1.3, is required in all spaces in which a fire might be expected to originate, 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<sup>2</sup>. The area of public space may be permitted to increase up to 75 m<sup>2</sup>.

**2.2.3.2** The requirements for the use of non-combustible materials in the construction of and insulation of boundary bulkheads of machinery spaces, control stations, service spaces, etc. and the requirements concerning the protection of stairway enclosures and corridors shall be common for all three methods.

**2.2.3.3** All divisions required to be B Class divisions shall extend from deck to deck and to the shell or other boundaries. Where continuous B Class ceilings or linings are fitted on both sides of the bulkhead, the bulkhead may terminate at such ceilings or linings.

**2.2.3.4** For a given method of fire protection, those divisions which are not required to be of A or B Class, shall be:

- for *method IC* – at least C Class construction;
- for *method IIC* – any, except in individual cases where C Class bulkheads are required in accordance with Table 2.2.2-1;
- for *method IIIC* – any, except that in no case must the area of any accommodation space or spaces bounded by A or B Class division exceed 50 m<sup>2</sup> (except in individual cases where C Class bulkheads are required in accordance with Table 2.2.2-1). The area of public space may be permitted to increase up to 75 m<sup>2</sup>.



**2.2.3.5** Interpretations regarding the use of construction materials in accommodation spaces on cargo ships are given in MSC/Circ. 1120, with reference to *SOLAS* regulation II-2/5.3 and II-2/6.2, see Appendix, tables – Method IC Method IIC – IIIC.

## **2.2.4 Protection of Stairways and Lift Trunks in Accommodation Spaces, Service Spaces and Control Stations**

**2.2.4.1** Stairways which penetrate only a single deck shall be protected at least at one level by B-0 Class divisions and self-closing doors. Lifts which penetrate only a single deck shall be surrounded by A-0 Class divisions with A-0 Class steel doors at both levels.

Dumb-waiters shall be regarded as lifts.

**2.2.4.2** Stairways and lift trunks which penetrate more than a single deck shall be surrounded by at least A-0 Class divisions and be protected by at least A-0 class steel self-closing doors at all levels <sup>1)</sup>.

**2.2.4.3** In ships having accommodation for 12 persons or less, where stairways penetrate more than one deck and where there are at least 2 escape routes direct to the open deck at every accommodation level, stairway enclosures and lift trunks may be of B-0 Class standard instead of A-0 Class standard.

## **2.2.5 Closures of Openings in Fire-Resisting Divisions, Fire-Resisting Divisions Penetrations and Prevention of Heat Transmission**

**2.2.5.1** All openings in fire-resisting divisions shall be provided with closing arrangements of fire integrity not lower than that of the division, in which they are fitted.

**2.2.5.2** Pippings, ventilation ducts and cables penetrations through A Class divisions are subject to tests in accordance with the *FTP Code* requirements, Annex 1, Part 3.

Pipe penetration testing is not required where the penetration is made of steel or steel equivalent material having a thickness of 3 mm or greater and a length of not less than 900 mm, fitted in such a way that the distance from the end of penetration to the division, on each side of the division, is not less than 450 mm and there are no openings. Such penetrations shall be suitably insulated by the insulation for a distance of at least 450 mm, measured from the surface of the division. Fire integrity of pipe penetration insulation shall be the same as that of the division.

Similarly, testing of steel ventilation ducts is not required where steel sleeves are made in accordance with the requirements specified in 11.2, *Part VI – Machinery Installations and Refrigerating Plants*, are directly joined to ventilation

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<sup>1)</sup> Interpretations regarding the construction of stairways on cargo ships are given in MSC/Circ.1120 with reference to *SOLAS* regulation II-2/9.2.3.4.1, see Appendix, Figs. 1, 2.1 and 2.2.

ducts by means of riveted or screwed flanges or by welding and are suitably insulated by the insulation of the same fire integrity as the division, for a distance of 450 mm, measured from the surface of the division.

This requirement is also applicable to the exterior boundaries of superstructures and deckhouses which are required to be A-60 Class divisions.

**2.2.5.3** Pipe penetrations through B Class divisions are subject to fire tests required for the division in which they are fitted.

Testing is not required for steel or copper pipe penetrations, as well as for penetrations by pipes other than steel or copper lined with a steel sleeve having a thickness of not less than 1.8 mm and a length of not less than 900 mm – for pipe diameters of 150 mm or more and of not less than 600 mm for pipe diameters of less than 150 mm (equally divided to each side of the division). If the pipe is not connected to the ends of the sleeve, the clearance between the sleeve and the pipe shall not exceed 2.5 mm or any clearance between the pipe and the sleeve shall be made tight by means of non-combustible or other suitable material.

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, such penetrations shall be lined with a steel sleeve in accordance with the requirements specified in 11.2.9, *Part VI – Machinery Installations and Refrigerating Plants*.

**2.2.5.4** Uninsulated metallic pipes penetrating A Class and B Class divisions shall be made of materials having a melting temperature which exceeds 950 °C – for A-0 Class divisions and 850 °C – for B-0 Class divisions.

**2.2.5.5** Pippings and ventilation ducts penetrating A Class and B Class fire divisions shall comply with the requirements of paragraphs 1.16.11.5 and 11.2, *Part VI – Machinery Installations and Refrigerating Plants*; cables penetrating fire divisions – with the requirements specified in sub-chapter 16.8.6, *Part VIII – Electrical Installations and Control Systems*.

**2.2.5.6** In the case of steel and aluminium structures, to avoid heat transmission at intersections and terminal points of insulation of decks or bulkheads, the insulation of decks or bulkheads regarded as A Class or B Class fire divisions shall be carried past the penetration, intersection or terminal point for a distance of at least 0.45 m<sup>1)</sup>.

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<sup>1)</sup> Details of measures to be adopted for avoiding heat transmission at intersections and terminal points of insulation of decks or bulkheads are given in MSC/Circ. 1120 for *SOLAS* regulation II-2/9.3.4, for details see Appendix, figures 1 and 2.

Alternative design may be accepted, provided that the effectiveness of such design is verified by an appropriate tests carried out in the same manner as those specified in the *FTP Code*.

In the case where the lower part of insulation has to be cut for drainage, the construction shall be in accordance with the structural details as given in Fig. 3 in the Appendix.

If a space is divided with a deck or bulkhead of A Class standard having insulation of different values, the insulation with the higher value shall continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 0.45 m.

### **2.2.6 Doors and Windows in Fire Divisions**

**2.2.6.1** The fire integrity of doors shall be equivalent to that of the division in which they are fitted, this being determined in accordance with the *FTP Code* requirements, Annex 1, Part 3. Doors and door frames in A Class divisions shall be constructed of steel or steel equivalent material. Doors in B Class divisions shall be constructed of non-combustible material.

Doors approved as A Class without the sill being part of the frame shall be so installed that the gap under the door does not exceed 12 mm and a non-combustible sill shall be so installed under the door that floor coverings do not extend beneath the closed door.

Doors approved as B Class without the sill being part of the frame shall be so installed that the gap under the door does not exceed 25 mm.

In ships, in which *IC method* of fire protection, specified in 2.2.3.1, is adopted, PRS may permit the use of combustible materials in doors separating cabins from individual interior sanitary accommodations, such as e.g. showers.

Where the required fire-resisting divisions are replaced by divisions of a higher standard, the fire integrity of the door need only conform to that of the required division.

**2.2.6.2** Doors required to be self-closing shall not be fitted with hold-back hooks. However, hold-back arrangements fitted with remote release hooks or other interlocking arrangements capable of automatic release in the event of remote release control failure or voltage decay, may be used.

**2.2.6.3** In corridor bulkheads, ventilation openings may be permitted only in and under the doors of cabins and public spaces. Ventilation openings are also permitted in B Class divisions leading to lavatories, offices, pantries, lockers and store-rooms. The openings shall be provided only in the lower part of a door. The total clear area of such openings shall not exceed 0.05 m<sup>2</sup>.

Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, located below the sanitary unit is permitted where the cross-sectional area of the duct does not exceed 0.05 m<sup>2</sup>. Ventilation openings, except those under the door, shall be fitted with a grill made of non-combustible material.

**2.2.6.4** Watertight doors regarded as fire doors need not be insulated.

**2.2.6.5** Doors fitted in fire divisions (self-closing and automatically-closing doors included) shall be so arranged as to be capable of being opened manually from either side of the division by one person only.

**2.2.6.6** Windows and portholes in the ship shell plating, as well as in superstructures and deckhouses shall comply with the requirements of sub-chapter 7.2, *Part III – Hull Equipment*.

## **2.3 Means of Escape**

### **2.3.1 General Requirements**

**2.3.1.1** Means of escape shall allow persons on board safe and swift escape to the lifeboat and liferaft embarkation deck. This deck shall be accessible from other open decks connected with means of escape.

**2.3.1.2** The escape routes are routes for escape and also for access. The door locking arrangement shall be such that it does not obstruct these two objectives (escape and access) and that the doors in the way of escape routes can be opened from both sides. Doors along any designated escape routes which require keys to unlock them when moving in the direction of escape shall not be permitted.

**2.3.1.3** Unless expressly provided otherwise in the present *Rules*, at least two widely separated and ready for use means of escape shall be provided from all spaces or group of spaces.

**2.3.1.4** Lifts shall not be considered as forming one of the required means of escape.

**2.3.1.5** To facilitate a swift and safe means of escape to the lifeboat and liferaft embarkation deck, overhead hatches fitted along the escape routes shall comply with the following requirements:

- .1** the securing devices shall be of a type which can be opened from both sides;
- .2** the maximum force needed to open the hatch cover shall not exceed 150 N; and
- .3** the use of a spring equalizing, counterbalance or other suitable device on the hinge side to reduce the force needed for opening is acceptable.

**2.3.1.6** The lift car shall ensure safe evacuation of persons, also in the emergency conditions. The lift car shall incorporate an escape hatch at the top of at least 0.5 x 0.5 m to enable evacuation when the lift automatically stops at a deck in the event of power failure. It should only be possible to open this from the outside, using a special key kept in a box by the hatch. The lifts shall be provided with a steel ladder allowing to take the persons, through escape hatch, to the nearest landing.

**2.3.1.7** Escape routes in all machinery spaces, cargo pump-rooms, cargo spaces and service spaces, in which the crew is normally employed or to which they have access, as well as in public spaces, corridors, stairways and on open decks, leading

to assembly stations, as well as exits and emergency exits from spaces shall be marked with symbols complying with Res. A.760(18).

These symbols shall be placed at an adult person eye level and shall be of photoluminescent material or of other material and marked by electric illumination, supplied from the emergency source of power.

**2.3.1.8** Escape routes shall be provided with lighting supplied from the main and the emergency source of power, see Chapter 6, *Part VIII – Electrical Installations and Control Systems*.

### **2.3.2 Means of Escape from Accommodation Spaces, Service Spaces and Control Stations**

#### **2.3.2.1 General Requirements**

**2.3.2.1.1** In accommodation and service spaces in which the crew is normally employed, stairways and ladders shall be provided giving ready means of escape to the lifeboat and life raft embarkation deck.

**2.3.2.1.2** At all levels of accommodation there shall be provided at least two widely separated means of escape from each enclosed space or group of spaces.

An enclosed space is a place in which the crew may normally be present, situated within another space, e.g. smoking room located in public space. Such public space shall be provided with 2 means of escape.

Accommodation cabins composed of more than one space may have only one means of escape.

**2.3.2.1.3** Unless expressly provided otherwise in sub-chapter 2.3, corridors, lobbies or parts of corridors from which there is only one means of escape shall 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 athwarship supply corridors may be permitted, provided such dead-end corridors are separated from crew accommodation areas and are inaccessible from passenger accommodation areas. A part of a corridor that has a depth not exceeding its width is considered a recess or local extension and is permitted.

**2.3.2.1.4** All stairways in accommodation and service spaces, as well as in control stations shall be of steel frame construction or of frame construction made from other equivalent material.

**2.3.2.1.5** If a radiotelegraph station has no direct access to the open deck, two means of escape from such station shall be provided. One of the means of escape may be a porthole or a window of sufficient size to enable the evacuation.

**2.3.2.1.6** The doors along the escape routes shall open outwards, except that:

- .1 the cabin doors may open into the cabins in order to avoid injury to persons in the corridor when the door is opened;
- .2 the doors in the 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.

### **2.3.2.2 Escape from Spaces Located below the Lowest Open Deck**

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

### **2.3.2.3 Escape from Spaces Located above the Lowest Open Deck**

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

### **2.3.2.4 Dead-end Corridors <sup>1)</sup>**

Dead-end corridors having a length of more than 7 m shall be prohibited.

In well-grounded cases, dead-end corridors are permitted in spaces located above the lowest open deck, provided that escape route from the dead-end of such corridor is a steel ladder leading to a deck above from which evacuation is possible and that there are two means of escape, complying with 2.3.2.3, at the end of the other end of such corridor. A window leading to the open deck is not accepted as a means of escape.

### **2.3.2.5 Width and Continuity of Escape Routes**

Stairways and corridors used as escape routes shall be not less than 0.7 m in clear width and shall have a handrail on one side. Stairways and corridors with a clear width of 1.8 m and over shall have handrails on both sides.

Clear width is the distance between the handrail and the bulkhead on the other side or between the handrails. The angle of inclination of stairways should be, in general, 45°. In well-justified cases, the angle of inclination may be increased to 50°; for machinery spaces and small spaces – to 60°.

The width of doorways which give access to a stairway shall be not less than the clear width of the stairway.

### **2.3.2.6 Dispensation from Two Means of Escape**

In exceptional cases, PRS 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.

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<sup>1)</sup> Dead-end corridor – a corridor or its part from which there is only one means of escape.

### 2.3.2.7 Location of Emergency Escape Breathing Devices

In all ships of 500 gross tonnage and upwards engaged on international voyages, at least 2 emergency escape breathing devices complying with 5.1.5 shall be located along the escape routes – in easily accessible places, within accommodation spaces.

### 2.3.3 Means of Escape from Machinery Spaces

#### 2.3.3.1 Escape from Machinery Space of Category A

From each machinery space of category A, two means of escape shall be provided which shall consist of either:

- .1 two sets of steel stairways or ladders<sup>1)</sup>, as widely separated as possible, leading to doors in the upper part of the machinery space and from which access is provided to the open deck. One of these stairways or ladders shall be located within a protected enclosure having the fire integrity as required for stairways in 2.2.2, category (4), from the lower part of the machinery space to a safe position outside the space. This enclosure shall be provided with self-closing fire doors of the same fire integrity standard. The ladder or stairway shall be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The protected enclosure shall have a free opening of at least 800 mm x 800 mm, the ladder being included. The enclosure shall be provided with emergency lighting; or
- .2 one steel stairway or ladder leading to a door in the upper part of machinery space and from which access is provided to the open deck and additionally, in the lower part of machinery space and in position well separated from the ladder or stairway 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.

#### 2.3.3.2 Dispensation from Two Means of Escape

In ships of less than 1000 gross tonnage, one of the means of escape required in 2.3.3.1 may be dispensed with, due regard being paid to the dimension and the arrangement of the upper part of the machinery space.

In ships of less than 1000 gross tonnage, the means of escape from machinery spaces of category A need not comply with the requirements for an enclosed fire shelter, specified in 2.3.3.1.1.

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

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<sup>1)</sup> Ladders having strings of flexible steel wire ropes are not acceptable in such escape routes.

### 2.3.3.3 Escape from Machinery Spaces other than those of Category A

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

### 2.3.3.4 Location of Emergency Escape Breathing Devices

On all ships of 500 gross tonnage and upwards engaged on international voyages, within the machinery spaces of category A, emergency escape breathing devices complying with 5.1.5 shall be located at visible places. The number of the devices shall be as follows:

- .1 in machinery spaces of category A containing internal combustion engines used for main propulsion:
  - 2 pcs. in one level spaces, located along escape routes near escape ladders or stairways. In spaces with more than one level, disregarding machinery spaces, additionally 1 pc. on every platform or deck level, located near escape ladders or stairways;
  - 1 pc. in ECR if ECR is located within the machinery space;
  - 1 pc. in the area of workshops if they are located in the machinery space. The breathing device shall be located outside, near escape doors from the workshop area. The device is not required if there is a direct access to an escape route from the workshop area.Additional devices may be required, depending on the size and arrangement of the machinery space;
- .2 in machinery spaces of category A, other than those containing internal combustion engines used for main propulsion:
  - 1 pc. on each platform or deck level, located near escape ladders or stairways. The breathing device is not required if the machinery space has one level and there is a direct access to an escape route.

## 2.4 Fire Protection of Accommodation Spaces, Service Spaces and Control Stations

### 2.4.1 Fixed Fire Detection and Fire Alarm System and Fire-Extinguishing Systems

2.4.1.1 On cargo ships, accommodation spaces, service spaces and control stations shall be protected by a fixed fire detection and fire alarm system complying with the requirements of 4.1 and/or automatic sprinkler system complying with the requirements of 3.3, depending on a protection *method* adopted as specified in 2.2.3.1, as follows:

- in ships in which *method IC* has been adopted, all corridors, stairways and escape routes within accommodation spaces and service spaces shall be



provided with a fixed fire detection and fire alarm system to provide smoke detection;

- in ships, in which *method IIC* has been adopted, accommodation spaces, galleys and other service spaces, except spaces which afford no substantial risk such as void spaces, sanitary spaces, etc. shall be fitted with an automatic sprinkler system. In addition, a fixed fire detection and fire alarm system shall be installed in all corridors, stairways and escape routes within accommodation spaces to provide smoke detection;
- in ships in which *method III C* has been adopted, all accommodation spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc. shall be fitted with a fixed fire detection and fire alarm system. In addition, a fixed fire detection and fire alarm system shall be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces.

Service spaces located away from the accommodation area need not be fitted with a fixed fire detection and fire alarm system.

**2.4.1.2** Manually operated call points shall be installed throughout the accommodation spaces, service spaces and control stations in accordance with the requirements of 4.1.2.

#### **2.4.2 Air Supply and Smoke Extraction System in Control Stations**

Control stations located outside machinery spaces shall be fitted with air supply and smoke extraction system complying with the requirements specified in subchapter 11.11, *Part VI – Machinery Installations and Refrigerating Plants* to ensure that, in the event of fire, the machinery and equipment contained therein may be supervised and continue to function effectively.

#### **2.4.3 Portable Fire-Extinguishers**

**2.4.3.1** The number of portable fire-extinguishers in public spaces shall be 1 fire-extinguisher per 250 m<sup>2</sup> of deck area or fraction thereof.

**2.4.3.2** In corridors, the walking distance to fire-extinguishers shall not exceed 25 m within each deck and main vertical zone.

**2.4.3.3** Hospital shall be provided with at least one fire-extinguisher.

**2.4.3.4** Laundry drying rooms and pantries containing cooking appliances shall be provided with at least one fire-extinguisher.

**2.4.3.5** Control stations (other than the wheelhouse) shall be provided with at least one fire-extinguisher.

**2.4.3.6** Where the wheelhouse is 50 m<sup>2</sup> and more, at least two fire-extinguishers shall be provided; where the wheelhouse is less than 50 m<sup>2</sup> – only one extinguisher. Additional fire-extinguisher shall be provided in the chartroom.

If the wheelhouse is adjacent to the chartroom and has a door giving direct access to the chartroom, no additional fire-extinguisher is required in the chartroom.

**2.4.3.7** Lockers and store-rooms (having a deck area of 4 m<sup>2</sup> or more), mail and baggage rooms, workshops (not part of machinery spaces) shall be provided with one extinguisher.

**2.4.3.8** In ships of 1000 gross tonnage and upwards, accommodation spaces, service spaces and control stations shall be provided with at least five portable fire-extinguishers.

## **2.5 Fire Protection Arrangements in Machinery Spaces**

### **2.5.1 Machinery Spaces Containing Oil-Fired Boilers or Oil Fuel Units**

#### **2.5.1.1 Fixed Total Flooding Fire-Extinguishing Systems**

In cargo ships of 150 gross tonnage and upwards, machinery spaces of category A containing oil-fired boilers or oil fuel units shall be provided with one of the following fixed total flooding fire-extinguishing systems:

- .1** a fixed carbon dioxide fire-extinguishing system complying with the requirements specified in 3.6.4;
- .2** a fixed high-expansion foam fire-extinguishing system complying with the requirements specified in 3.5.3;
- .3** a fixed water-spraying fire-extinguishing system or equivalent high-pressure water-based spraying fire-extinguishing system complying with the requirements specified in 3.4.4.

As an alternative, an equivalent gas fire-extinguishing system complying with the requirements of 3.7.1, or aerosol fire-extinguishing system, specified in 3.7.2, may be used.

If the machinery space and boiler room are not entirely separated by a steel partition or oil fuel can drain from the boiler room into the machinery space, the machinery space and the boiler room shall be considered as one compartment.

#### **2.5.1.2 Portable Fire-Fighting Equipment**

Each machinery space containing oil-fired boilers shall be provided with the following fire-fighting equipment:

- .1 in ships of 500 gross tonnage and upwards – with mobile foam-extinguisher of at least 135 l capacity or equivalent<sup>1)</sup>, with hoses on reels suitable for reaching any part of the space. In the case of domestic boilers of less than 175 kW, such foam-extinguisher is not required;
- .2 in every ship – with at least two portable foam extinguishers – in each firing space and in each space in which a part of the oil fuel installation is situated;
- .3 in ships of 500 gross tonnage and upwards – with a portable foam applicator unit, complying with the requirements of 5.1.3. The applicator may be located in the machinery space or at an entrance, outside of the space;
- .4 in ships of 500 gross tonnage and upwards – with 0.1 m<sup>3</sup> capacity receptacle containing sand, sawdust impregnated with soda or other equivalent dry material, located in the boiler firing space. A scoop shall be provided at the receptacle. A portable 6 kg dry-powder fire-extinguisher may be used as an alternative.

## **2.5.2 Machinery Spaces Containing Internal Combustion Engines**

### **2.5.2.1 Fixed Total Flooding Fire-Extinguishing Systems**

In ships of 150 gross tonnage and upwards, machinery spaces of category A containing internal combustion engines shall be provided with a fixed total flooding fire-extinguishing system required in 2.5.1.1.

### **2.5.2.2 Portable Fire-Fighting Equipment**

Each machinery space containing internal combustion engines shall be provided with the following portable fire-fighting equipment:

- .1 in ships of 500 gross tonnage and upwards, a foam-type mobile fire-extinguisher of 45 l capacity or equivalent<sup>2)</sup>, to enable foam or its equivalent to be directed on to any part of the fuel or lubricating oil pressure system, gearing or other fire hazards. In cargo ships the extinguisher may be arranged outside machinery space, near the entrance to the space;
- .2 in every ship – with portable foam extinguishers so located that no point in the machinery space is more than 10 m walking distance from an extinguisher and that there are at least two such extinguishers in each such space;

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<sup>1)</sup> Mobile 50 kg dry powder extinguisher and mobile 45 kg CO<sub>2</sub> extinguisher are considered equivalent.

<sup>2)</sup> Mobile 25 kg dry powder extinguisher and mobile 20 kg CO<sub>2</sub> extinguisher are considered equivalent.

- .3 in ships of 500 gross tonnage and upwards, a portable foam applicator unit complying with the requirements of 5.1.3. Such unit may be located inside the machinery space or outside the space, at the entrance to the space.

Additionally, in ships of 500 gross tonnage and upwards, machinery spaces of category A shall be provided with portable fire-extinguishers, arranged as follows:

- .4 in engine control room – at least one fire-extinguisher; additional fire-extinguisher shall be provided when main switchboards are arranged in the engine control room;
- .5 in the vicinity of the main switchboards – two fire-extinguishers;
- .6 in each enclosed workshop – at least one fire-extinguisher;
- .7 in enclosed spaces with oil-fired inert gas generators – two fire-extinguishers.

### **2.5.3 Machinery Spaces Containing Steam Turbines or Enclosed Steam Engines**

#### **2.5.3.1 Fixed Total Flooding Fire-Extinguishing Systems**

For periodically unattended spaces, see 6.16.3.1.

#### **2.5.3.2 Portable Fire-Fighting Equipment**

Each machinery space containing steam turbines or enclosed steam engines shall be provided with the following portable fire-fighting equipment:

- .1 in ships of 500 gross tonnage and upwards, mobile foam-type fire-extinguishers of 45 l capacity or equivalent, sufficient in number to enable foam or its equivalent to be directed onto any part of the turbine or engine pressure lubrication system, onto any part of the casing enclosing pressure-lubricated parts of the turbines, engines or associated gearing and any other fire hazards. Such extinguishers need not be used if fire protection is provided in such spaces by a fixed fire-extinguishing system, required in 2.5.1.1;
- .2 in every ship – portable foam extinguishers so arranged 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.

#### **2.5.4 Other Machinery Spaces**

Any machinery space, other than that listed in 2.5.1, 2.5.2 and 2.5.3 (auxiliary spaces, electrical equipment spaces, air-conditioning equipment spaces and other similar spaces), shall be provided with at least one portable fire-extinguisher.

#### **2.5.5 Rooms Containing Fuel Oil Purifiers**

**2.5.5.1** A separate room containing fuel oil purifiers for heated fuel oil shall be provided with:

- .1 independent mechanical ventilation, see 11.3.4, *Part VI – Machinery Installations and Refrigerating Plants*;
- .2 fire detection and fire alarm system, complying with the requirements specified in 4.1; and
- .3 a fixed fire-extinguishing system capable of being activated from outside of the room. The system shall operate independently of the machinery space total flooding fire-extinguishing system, but may constitute its part.

**2.5.5.2** Ventilation switching off and closing of ventilation openings in fuel oil purifiers room shall be effected from a position close to the place from which the fire-extinguishing system is activated.

**2.5.5.3** Where the oil fuel purifiers are not placed in a separate room, they shall be protected by a local water-based fire-extinguishing system (see 2.5.8), capable of being activated automatically or activated manually from the machinery control position or from other suitable location. If automatic release is provided, additional manual release shall be arranged.

**2.5.5.4** Fuel oil purifiers room shall be provided with at least one portable fire-extinguisher.

## **2.5.6 Main and Auxiliary Internal Engines Silencers**

**2.5.6.1** It is recommended that for main and auxiliary internal combustion engines silencers, exhaust gas boilers, exhaust pipes of steam boilers and incinerators, as well as gas turbine system regenerators, a local carbon-dioxide fire-extinguishing system complying with the requirements of 3.6.6, independent of the fixed total flooding fire-extinguishing system, required in 2.5.1.1, should be provided.

**2.5.6.2** For crosshead type engines, scavenge spaces in open connection to the cylinder shall be connected to an approved local CO<sub>2</sub> fire-extinguishing system, specified in 3.6.6 or equivalent fire-extinguishing system in accordance with the engine manufacturer's requirements (see 2.1.6, *Part VII – Machinery, Boilers and Pressure Vessels*). The local fire-extinguishing system shall be entirely separate from the fire-extinguishing system of the engine room.

## **2.5.7 Fire Detection and Fire Alarm System**

**2.5.7.1** In ships of 500 gross tonnage and upwards, a fixed fire detection and fire alarm system with detectors and manually operated call points, complying with the requirements of 6.16.2, shall be installed in machinery spaces of category A:

- .1 periodically unattended machinery spaces, see 6.16.2.1;
- .2 machinery spaces where:

- the installation of automatic and remote control systems and equipment have been approved in lieu of continuous manning of the space;
- the main propulsion and associated machinery, including the main sources of electrical power, are provided with various degrees of automatic or remote control and are under continuous manned supervision from the engine control room;

**.3** enclosed spaces containing incinerators.

Machinery spaces other than machinery spaces of category A containing flammable materials / liquid fuel in quantities constituting fire hazard, shall be fitted with fire detectors.

**2.5.7.2** In cargo ships of less than 500 gross tonnage, all machinery spaces of category A shall be fitted with fire detection and fire alarm system complying with the applicable requirements, specified in 6.16.2 – see 6.21.3.

**2.5.7.3** Fire detection and alarm system with fire detectors shall be installed in the location where the emergency generator set and the emergency switchboard, for use in port, are installed.

### **2.5.8 Fixed Local Application Fire-Extinguishing System**

In cargo ships of 2000 gross tonnage and upwards, machinery spaces of category A above 500 m<sup>3</sup> in volume shall, in addition to the fixed total flooding fire-extinguishing system, required in 2.5.1.1, be fitted with a fixed local water-based fire-extinguishing system complying with the requirements of 3.4.6 or equivalent local application fire-extinguishing system of an approved type.

### **2.5.9 Arrangements for Release of Smoke from Machinery Spaces**

Machinery spaces of category A and, where deemed necessary, other machinery spaces shall be provided with arrangements permitting the release of smoke, in the event of fire, in accordance with the requirements specified in 11.3.7, *Part VI – Machinery Installations and Refrigerating Plants*.

### **2.5.10 Oil Mist Detection System**

It is recommended that machinery spaces of category A, in locations of potential oil/fuel leaks, should be provided with atmospheric oil mist detectors, in accordance with MSC/Circ. 1086. Oil mist detection system is subject to PRS' approval.

## **2.6 Fire Protection Arrangements in Cargo Spaces**

### **2.6.1 Fixed Gas Fire-Extinguishing Systems for General and Bulk Cargoes**

**2.6.1.1** Except for ro-ro and vehicle spaces covered by other requirements, cargo spaces in cargo ships of 2000 gross tonnage and upwards shall be protected by

a fixed carbon dioxide fire-extinguishing system complying with the requirements specified in 3.6.4 or an equivalent gas fire-extinguishing system which gives equivalent protection.

**2.6.1.2** The Flag State Administration may exempt from the requirements, specified in 2.6.1.1 and 2.6.2, cargo spaces of any cargo ship if:

- .1 constructed, and solely intended, for the carriage of ore, coal, grain, unseasoned timber, non-combustible cargoes or cargoes which constitute a low fire risk; and
- .2 if the ship is fitted with steel hatch covers and effective means of closing all ventilators and other openings leading to the cargo spaces.

**2.6.1.3** The list of solid bulk cargoes for which the ship may be exempted from providing cargo spaces with a fixed gas fire-extinguishing system is given in Appendix to MSC.1/Circ.1395, Table 1.

Such cargoes include also non-combustible materials, listed in para.1 of Annex 2 to the *FTP Code*, such as products made of glass, concrete, ceramic products, natural stone, masonry units, metals, etc.

## **2.6.2 Fixed Gas Fire-Extinguishing Systems for Dangerous Goods**

**2.6.2.1** In ships of 500 gross tonnage and upwards engaged in the carriage of dangerous goods on deck or in cargo spaces, each cargo space shall be provided with a fixed carbon dioxide fire-extinguishing system complying with the requirements of 3.6.4 or a gas fire-extinguishing system which gives equivalent protection for the carried cargoes, see 2.10.1.4.

For the control of the self-heating of the cargoes within the cargo holds, a separate fixed carbon dioxide fire-extinguishing system or an equivalent gas fire-extinguishing system need not be provided<sup>1)</sup>.

**2.6.2.2** In the case of solid dangerous bulk cargoes for which a gas fire-extinguishing system is ineffective, a system which gives equivalent protection shall be provided. It may be a water-spraying fire-extinguishing system complying with the requirements of 3.4, with the application rate of at least 5 l/min per square metre of the cargo hold area. The system may be supplied by its own pump or from

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<sup>1)</sup> For certain individual schedules of solid bulk cargoes subject to self-heating, specified in Appendix 1 of the *IMSBC Code*, such as: FISHMEAL (FISHSCRAP) STABILIZED UN 2216, SEED CAKE, containing vegetable oil UN 1386 and SEED CAKE UN 2217, the following ventilation requirement applies: if the temperature of the cargo exceeds 55°C and continues to increase, this self-heating of the cargo shall be regarded as an emergency condition in which ventilation to the cargo space shall be stopped and the fixed carbon dioxide or an equivalent inert gas fire-extinguishing system required for the protection of the cargo space shall be used to control the self-heating of the cargo. Fixed gas fire-extinguishing systems or inert gas systems installed on board to protect spaces other than cargo spaces cannot be used for this purpose.

the water fire main, provided the requirements, specified in 2.10.3.2.3, regarding water supply are complied with.

Water supplies (four jets of water), specified in 2.10.3.2, are considered as an acceptable protection for cargoes for which a gas fire-extinguishing system is ineffective.

**2.6.2.3** For the list of solid bulk cargoes, for which a gas fire-extinguishing system is ineffective and for which a fire-extinguishing system giving equivalent protection shall be provided – see Annex to MSC.1/Circ 1395, Table 2.

## **2.7 Fire Protection of Galley Spaces**

### **2.7.1 Galley Exhaust Duct**

**2.7.1.1** In cargo ships of 500 gross tonnage and upwards, exhaust ducts from galley ranges passing through accommodation spaces (applies to all spaces defined as accommodation spaces, the definition being given in 1.2.51) or spaces containing combustible materials situated in accommodation area shall be constructed of A Class divisions (applies only to the part of the duct outside of the galley) and shall comply with the applicable requirements for ventilation ducts, set forth in Chapter 11, *Part VI – Machinery Installations and Refrigerating Plants*. Additionally, the exhaust duct shall be fitted with:

- .1** a grease trap readily removable for cleaning;
- .2** a fire damper located in the lower end of the duct at the junction between the duct and the galley range hood; in addition, a fire damper shall also be provided in the upper end of the duct, near the duct outlet;
- .3** fixed means for extinguishing fire within the duct. If carbon dioxide system is fitted, it shall comply with the requirements of 3.6.7.

**2.7.1.2** Arrangements, operable from within the galley, for shutting off the exhaust and air supply fans shall be provided.

**2.7.1.3** The fire damper need not be subjected to fire test, but it shall be of steel and capable of stopping the air draught.

**2.7.1.4** Galley exhaust duct passing through accommodation spaces or spaces containing combustible materials shall be fitted with insulation of the same fire integrity as required for the galley space. If the galley exhaust duct is contiguous to such spaces, the insulation shall be carried along the duct and for a distance of at least 450 mm from the duct edge<sup>1)</sup>.

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<sup>1)</sup> Examples of the ventilation duct insulation are given in MSC.1/Circ.1276, interpretations of SOLAS regulations II-2/9.7.2.1, II-2/9.7.2.2 and II-2/9.7.5.2.1.



### 2.7.2 Deep-Fat Cooking Equipment

Deep-fat cooking equipment, installed in closed spaces or open decks, shall be fitted with the following:

- .1 an automatic or manual fire-extinguishing system using fire-extinguishing agent suitable for extinction of burning fat, subject to tests in accordance with ISO 15371: 2009<sup>1)</sup>;
- .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 fire-extinguishing system;
- .4 an alarm for indicating operation of the fire-extinguishing system in the galley where the equipment is installed; and
- .5 controls for manual operation of the fire-extinguishing system, clearly labelled.

### 2.7.3 Portable Fire-Extinguishers

Galleys shall be provided with at least one Class B fire-extinguisher; one additional Class F or K fire-extinguisher shall be provided for galleys fitted with deep-fat cooking equipment.

## 2.8 Fire Protection of Store-Rooms for Paints and Flammable Liquids

**2.8.1** The store-rooms for paints and flammable liquids shall be located away of accommodation areas. Exits from the store-rooms shall lead directly to the open deck.

**2.8.2** In cargo ships of 500 gross tonnage and upwards, the store-rooms shall be provided with one of the following fire-extinguishing systems:

- .1 a carbon dioxide system, the quantity of CO<sub>2</sub> being calculated in accordance with 3.6.4.1.1, assuming filling factor  $\varphi = 0.4$ ;
- .2 a dry powder system designed for at least 0.5 kg powder/m<sup>3</sup>;
- .3 a water-spraying fire-extinguishing system or sprinkler system, with the water discharge rate not less than 5 l/min per square metre of the floor. This system may be supplied from the water fire main;
- .4 a system providing equivalent protection.

In all cases, the fire-extinguishing system shall be operable from outside of the store-room.

Additionally, such store-rooms shall be provided with one portable fire-extinguisher.

**2.8.3** For lockers of a deck area of less than 4 m<sup>2</sup>, which do not give access to accommodation spaces, a portable carbon dioxide fire-extinguisher sized to provide

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<sup>1)</sup> For ships constructed before 1 July 2013, ISO 15371:2000 may be used.

the quantity of CO<sub>2</sub> not less than that calculated in accordance with 2.8.2.1 may be accepted in lieu of a fixed system. A discharge port shall 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 shall be stowed adjacent to the port.

Alternatively, a port or hose connection may be provided to facilitate the use of the water fire main.

## **2.9 Fire Protection of Spaces Intended for Garbage Storage and Processing**

**2.9.1** In ships of 2000 gross tonnage and upwards, spaces intended for the storage and processing of garbage shall be fitted with water-spraying fire-extinguishing system complying with the requirements of 3.4. The water-spraying system may be supplied from the water fire main or fresh water pressure tank system.

If provision has been made for fitting an automatic sprinkler system on the ship, the spaces, referred to above, may be protected by the sprinkler system.

**2.9.2** In ships of 500 gross tonnage and upwards, incinerators rooms located outside machinery space shall be fitted with fire detection and fire alarm system complying with the requirements specified in 4.1, as well as one of the fire-extinguishing systems required for machinery spaces of category A, listed in 2.5.1.1.

**2.9.3** Incinerators rooms shall be provided with at least one portable fire-extinguisher.

## **2.10 Additional Requirements for Ships Carrying Dangerous Goods**

### **2.10.1 General Requirements**

**2.10.1.1** Ships engaged in the carriage of dangerous goods – dangerous goods classes, see the definitions given in 2.10.1.9 – shall additionally comply with the relevant requirements of the present sub-chapter and the provisions of the *IMDG Code* or the *IMSBC Code*, as amended.

**2.10.1.2** Compliance with these requirements is confirmed by *Certificate of Compliance for Ships Carrying Dangerous Goods* issued to a ship after satisfactory completion of ship survey, in accordance with Annex 1, MSC.1/Circ. 1266.

**2.10.1.3** The requirements of the present sub-chapter are not applicable to the carriage of dangerous goods in limited quantities as specified for the relevant goods class concerned in Chapters 3.4 and 3.5 of the *IMDG Code*.

**2.10.1.4** In ships of 500 gross tonnage and upwards, engaged in the carriage of dangerous goods on deck or in cargo spaces, each cargo space shall be fitted with a fixed fire-extinguishing system – see 2.6.2.1.

**2.10.1.5** Cargo ships of less than 500 gross tonnage shall comply with the requirements of the present sub-chapter, but, subject to PRS' acceptance, the requirements may be reduced and such reduced requirements shall be recorded in the *Appendix to Document of Compliance*.

**2.10.1.6** Ships engaged in the carriage of dangerous goods shall be additionally provided with three hoses and nozzles, located on the open deck.

**2.10.1.7** When dangerous goods are carried on the weather deck, in open ro-ro spaces and vehicle spaces, two portable fire-extinguishers, each having a capacity of not less than 6 kg of dry powder or equivalent, located in the vicinity of the cargoes shall be additionally provided.

**2.10.1.8** To verify whether the ship construction and equipment intended for the carriage of declared dangerous goods comply with the requirements specified in the present sub-chapter, the following technical documentation shall be submitted for approval:

- .1 water fire main (calculations of the capacities and the arrangement of fire hydrants);
- .2 water spraying fire-extinguishing system (designated cargo space flooding);
- .3 electrical equipment and wiring in cargo spaces (details of electrical components installation/certificates for use in dangerous environments);
- .4 fire detection and fire alarm system;
- .5 ventilation system;
- .6 bilge system;
- .7 structure of divisions separating cargo spaces from machinery space of category A;
- .8 arrangement plan of fire-fighting equipment/fire-control plan.

**2.10.1.9** For the purpose of the present sub-chapter, dangerous goods have been divided into classes and groups in accordance with the *IMDG Code* and the *IMSBC Code*. The following definitions of dangerous goods classes and groups apply:

## **CARRIAGE OF DANGEROUS CARGOES IN PACKED FORM**

Division into classes:

### **Class 1 – explosive materials**

Class 1 comprises:

- .1 explosive substances (a substance which is not itself an explosive but which can form an explosive atmosphere of gas, vapour or dust is not included in class 1), except those which are too dangerous to transport or those where the predominant hazard is one appropriate to another class;
- .2 explosive articles, except devices containing explosive substances in such quantity or of such a character that their inadvertent or accidental ignition

or initiation during transport shall not cause any effect external to the device either by projection, fire, smoke, heat or loud noise;

- .3** substances and articles not mentioned under .1 and .2 which are manufactured with a view to producing a practical, explosive or pyrotechnic effect.

Transport of explosive substances which are unduly sensitive, or so reactive as to be subject to spontaneous reaction, is prohibited.

**Division 1.1:** substances and articles which have a mass explosion hazard. A mass explosion is one which affects almost the entire load virtually instantaneously.

**Division 1.2:** substances and articles which have a projection hazard but not a mass explosion hazard.

**Division 1.3:** substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

**Division 1.4:** substances and articles which present no significant hazard.

**Division 1.5:** very insensitive substances which have a mass explosion hazard.

**Division 1.6:** extremely insensitive articles which do not have a mass explosion hazard.

**Subdivision 1.4 S in compatibility group S:**

Substances and articles so packaged or designed that any hazardous effects arising from the accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder fire fighting or other emergency response efforts in the immediate vicinity of the package.

**Class 2 – gases**

**Class 2.1:** flammable gases

**Class 2.1:** flammable non-toxic gases

**Class 2.2:** non-flammable, non-toxic gases

**Class 2.3:** toxic gases

**Class 2.3:** flammable toxic gases

**Class 2.3:** non-flammable toxic gases

**Class 3 – flammable liquids**

**Class 3 FP < 23°C:** flammable liquids with a flash-point less than 23 °C (closed-cup test)

**Class 3 23°C FP 60°C:** flammable liquids with a flash-point of 23 °C or above and less than or equal to 60°C (closed-cup test)

**Class 3 – liquid desensitized explosives**

**Class 4 – flammable solids; substances liable to spontaneous combustion; substances which, in contact with water, emit flammable gases****Class 4.1:** flammable solids, self-reactive substances and solid desensitized explosives

Solids which, under conditions encountered in transport, are readily combustible or may cause or contribute to fire through friction; self-reactive substances (solids and liquids) which are liable to undergo a strongly exothermic reaction; solid desensitized explosives which may explode if not diluted sufficiently.

**Class 4.2: substances liable to spontaneous combustion**

Substances (solids and liquids) which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up in contact with air, and being then liable to catch fire.

**Class 4.3: substances which, in contact with water, emit flammable gases liquids**

Substances (solids and liquids) which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

**Class 4.3 liquids:**

Liquids which, in contact with water, emit flammable gases.

**Class 4.3 solids:**

Solids which, in contact with water, emit flammable gases.

**Class 5 – oxidizing substances and organic peroxides****Class 5.1: oxidizing substances**

Substances which, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material. Such substance may be contained in an article.

**Class 5.2: organic peroxides**

Organic substances which contain the bivalent -O-O- structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. Organic peroxides are thermally unstable substances which may undergo exothermic self-accelerating decomposition. In addition, they may have one or more of the following properties:

- be liable to explosive decomposition,
- burn rapidly,
- be sensitive to impact or friction,
- react dangerously with other substances,
- cause damage to the eyes.

**Class 6 – toxic and infectious substances****Class 6.1: Toxic substances**

These are substances liable either to cause death or serious injury or to harm human health if swallowed or inhaled, or by skin contact.

**Class 6.1 FP < 23°C:** toxic substances with a flash-point less than 23 °C

**Class 6.1 23°C FP 60°C:** toxic substances with a flash-point of 23 °C or above and less than or equal to 60°C

**Class 6.1 liquids:** toxic liquids with a flash-point greater than 60 °C

**Class 6.1: toxic solids**

**Class 6.2: infectious substances**

These are substances known or reasonably expected to contain pathogens. Pathogens are defined as micro-organisms (including bacteria, viruses, rickettsiae, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.

**Class 7: radioactive materials**

Radioactive material means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in the *IMDG Code*.

**Class 8: corrosive substances**

Substances which, by chemical action, will cause severe damage when in contact with living tissue or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.

**Class 8 liquids FP < 23°C:** corrosive liquids with a flash-point less than 23 °C

**Class 8 liquids 23°C FP 60°C:** corrosive liquids with a flash-point of 23 °C or above and less than or equal to 60°C

**Class 8 liquids:** corrosive liquids with a flash-point greater than 60 °C

**Class 8 solids:** corrosive solids

**Class 9: miscellaneous dangerous substances and articles**

Dangerous substances and articles are substances and articles which, during transport, present a danger not covered by other classes.

## **CARRIAGE OF SOLID DANGEROUS GOODS IN BULK**

Division into groups:

**Group A** – cargoes which may liquefy when the actual moisture is higher than the cargoes transported moisture limit.

**Group B** – cargoes which possess a chemical hazard which could give rise to a dangerous situation on a ship.

**Group C** – cargoes which are not liable to liquefy (Group A) and do not possess chemical hazards (Group B).

Division into classes:

**Class 4.1: flammable solids**

The materials in this class are readily combustible solids and solids which may cause fire through friction.

**Class 4.2: substances liable to spontaneous combustion**

The materials in this class are materials, other than pyrophoric materials, which, in contact with air without energy supply, are liable to self-heating.

**Class 4.3: substances which, in contact with water, emit flammable gases**

The materials in this class are solids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

**Class 5.1: oxidizing substances**

The materials in this class are materials while in themselves not necessarily combustible, may, generally, by yielding oxygen cause, or contribute to, the combustion of other material.

**Class 6.1: toxic substances**

The materials in this class are materials liable either to cause death or serious injury or to harm human health if swallowed or inhaled, or by skin contact.

**Class 8: corrosive substances**

The materials in this class are materials which, by chemical action, will cause severe damage when in contact with living tissue or will materially damage, or even destroy, other goods or the means of transport.

**Class 9: miscellaneous dangerous substances and articles**

The materials in this class are materials and articles which, during transport, present a danger not covered by other classes.

**Class MHB: materials hazardous only in bulk**

These are materials which may possess chemical hazards when transported in bulk other than materials that are classified in the *IMDG Code* as dangerous cargoes.

**2.10.2 Requirements with Respect to Class of the Carried Dangerous Goods**

**2.10.2.1** Unless expressly provided otherwise, the requirements specified in sub-chapter 2.10 are applicable to dangerous goods carried both in cargo spaces and on the open deck.

**2.10.2.2** Tables 2.10-1 and 2.10-2 contain requirements specified in sub-chapters 2.10.3 and 2.10.12, which are applicable to the following ship types and cargo spaces:

- .1** ships and cargo spaces not specifically 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;
- .2** container ships and cargo spaces intended for the carriage of dangerous goods in freight containers and portable tanks <sup>1)</sup>;

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<sup>1)</sup> A purpose-built container space is a cargo space fitted with cell guides for the stowage and securing of containers.

- .3 ro-ro ships and ro-ro cargo spaces, special category spaces and vehicle deck spaces intended for the carriage of dangerous goods;
- .4 ships and cargo spaces intended for the carriage of solid dangerous goods in bulk;
- .5 ships and cargo spaces intended for the carriage of dangerous goods other than liquids and gases in bulk (in shipborne barges).

**2.10.2.3** Table 2.10-2 contains the requirements, specified in 2.10.3 to 2.10.10, with respect to particular classes of solid dangerous goods carried in bulk.

**2.10.2.4** Tables 2.10-1, 2.10-2 and 2.10-3 contain the requirements, specified in Chapters 2.10.3 to 2.10.12, with respect to particular classes of dangerous goods carried in packed form.

### **2.10.3 Supply of Water from the Water Fire Main System**

#### **2.10.3.1 Availability of Water Supply**

Arrangements shall be made to ensure immediate availability of water supply from the water fire main at the required pressure by permanent pressurization and automatic start of a fire pump or by remote starting of the fire pump from the navigation bridge.

#### **2.10.3.2 Water Supply Quantity and the Arrangement of Fire Hydrants**

**2.10.3.2.1** The quantity of water delivered shall be sufficient to supply four nozzles of a size and at pressures as specified in 3.2. This amount of water may be supplied by equivalent means complying with PRS' requirements.

**2.10.3.2.2** The number and position of hydrants shall be such that any part of the empty cargo spaces can be reached with four jets of water not emanating from the same hydrant. Two of the jets shall be supplied by a single length of hose each, two may be supplied by two coupled hose lengths each. All four jets of water, each supplied by a single length of hose, shall reach any part of ro-ro cargo spaces.

**2.10.3.2.3** On open-top container ships, the water spraying fire-extinguishing system complying with the requirements specified in 3.4.8, will also satisfy the requirement for the carriage of dangerous goods.

The amount of water required for fire-fighting purposes in the largest hold shall allow simultaneous use of the water spray system plus four jets of water from hose nozzles.



**Table 2.10-1**  
**Application of the requirements to different modes of carriage**  
**of dangerous goods in ships and cargo spaces**

Where X appears in the Table, it means that this requirement is applicable to all classes of dangerous goods as given in the appropriate line of Table 2.10-3, except as indicated by the Notes to the Table.

Paragraph - 2.10.2.2	Weather decks of ships listed in 1. to 5.	.1	.2	.3		.4	.5
		Not specially designed	Container cargo spaces	Closed ro-ro spaces <sup>5</sup>	Open ro-ro spaces <sup>*</sup>	Solid dangerous goods in bulk	Shipborne barges
2.10.3.1	X	X	X	X	X	For application of requirements of sub-chapter 2.10 to different classes of dangerous goods, see Table 2.10-2	X
2.10.3.2	X	X	X	X	X		-
2.10.3.3	-	X	X	X	X		X
2.10.3.4	-	X	X	X	X		X
2.10.4	-	X	X	X	X		X <sup>4</sup>
2.10.5	-	X	X	X	-		X <sup>4</sup>
2.10.6.1	-	X	X <sup>1</sup>	X	-		X <sup>4</sup>
2.10.6.2	-	X	X <sup>1</sup>	X	-		X <sup>4</sup>
2.10.7	-	X	X	X	-		-
2.10.8.1	X	X	X	X	X		-
2.10.8.2	X	X	X	X	X		-
2.10.9	X	X	-	-	X		-
2.10.10	X	X	X <sup>2</sup>	X	X		-
2.10.11	-	-	-	X <sup>3</sup>	X		-
2.10.12.1	-	-	-	X	-		-
2.10.12.2	-	-	-	X	-		-

\* A ro-ro space fully open above and with full openings in both ends may be treated as a weather deck.

**Notes:**

- <sup>1</sup> For classes 4 and 5.1 not applicable to closed freight containers. For classes 2, 3, 6.1 and 8, where 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 liquids where 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.
- <sup>2</sup> Applicable to decks only.
- <sup>3</sup> Applies only to closed ro-ro spaces, not capable of being sealed.
- <sup>4</sup> Where the barges are capable of containing flammable vapours or alternatively if they are capable of discharging flammable gases 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 PRS.
- <sup>5</sup> Special category spaces shall be treated as closed ro-ro cargo spaces when dangerous goods are carried.

**Table 2.10-2**  
**Application of the requirements to different classes of dangerous goods**  
**for ships and cargo spaces carrying solid dangerous goods in bulk**

Class Sub-chapter	4.1	4.2	4.3 <sup>6</sup>	5.1	6.1	8	9
2.10.3.1	X	X	–	X	–	–	X
2.10.3.2	X	X	–	X	–	–	X
2.10.4	X	X <sup>7</sup>	X	X <sup>8</sup>	–	–	X <sup>8</sup>
2.10.6.1	–	X <sup>7</sup>	X	–	–	–	–
2.10.6.2	X <sup>9</sup>	X <sup>7</sup>	X	X <sup>7,9</sup>	–	–	X <sup>7,9</sup>
2.10.6.3	X	X	X	X	X	X	X
2.10.8	X	X	X	X	X	X	X
2.10.10	X	X	X	X <sup>7</sup>	–	–	X <sup>10</sup>

**Notes:**

- <sup>6</sup> The hazards of substances in this class which may be carried in bulk are such that special consideration must be given to the construction and equipment of the ship involved in addition to meeting the requirements enumerated in this Table.
- <sup>7</sup> Only applicable to Seedcake containing solvent extractions, to Ammonium nitrate and to Ammonium nitrate fertilizers.
- <sup>8</sup> Only applicable to Ammonium nitrate and to Ammonium nitrate fertilizers. However, a degree of protection in accordance with standards specified in *IEC Publication 60079 – Electrical Apparatus for Explosive Gas Atmospheres*, is sufficient.
- <sup>9</sup> Only suitable wire mesh guards are required.
- <sup>10</sup> The requirements of the *IMSBC Code* are sufficient.



**Notes to the Table 2.10-3:**

- <sup>11</sup> When mechanically ventilated spaces are required by the *IMDG Code*.  
<sup>12</sup> Stow 3 m horizontally away from the machinery space boundaries in all cases.  
<sup>13</sup> Refer to the *IMDG Code*.  
<sup>14</sup> As appropriate to the goods being carried.  
<sup>15</sup> FP is a flash point.  
<sup>16</sup> Under the provisions of the *IMDG Code*, stowage of Class 5.2 dangerous goods under deck or in enclosed ro-ro spaces is prohibited.  
<sup>17</sup> Only applicable to dangerous goods evolving flammable vapour, listed in the *IMDG Code*.  
<sup>18</sup> Only applicable to dangerous goods having a flash point below 23 °C, listed in the *IMDG Code*.  
<sup>19</sup> Only applicable to dangerous goods having a subsidiary risk class 6.1.  
<sup>20</sup> Under the provisions of the *IMDG Code*, stowage of class 2.3 liquids having a subsidiary risk class 2.1 under deck or in enclosed ro-ro spaces is prohibited.  
<sup>21</sup> Under the provisions of the *IMDG Code*, stowage of class 4.3 liquids having a flash point below 23°C under deck or in enclosed ro-ro spaces is prohibited.

**2.10.3.3 Cooling the Designated Cargo Space**

**2.10.3.3.1** Means shall be provided for effectively cooling the designated under-deck space by at least 5 l/min per square metre of the horizontal area of cargo spaces, either by a fixed arrangement of spraying nozzles or by flooding the cargo space with water.

The water may be supplied by means of the main fire pumps. The required water shall be distributed evenly over the cargo space area from above via a fixed piping system and full bore nozzles. The piping and nozzle system may be divided into sections and be integrated into the hatch covers. Connection may be via hoses with quick-acting couplings. Additional hydrants shall be provided on deck for this purpose.

**2.10.3.3.2** Hoses may be used for this purpose in small cargo spaces and in small areas of larger cargo spaces at the discretion of PRS.

**2.10.3.3.3** The drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces. The drainage system :

- .1** shall be seized to remove not less than 125% of the combined capacity of both the water spraying pumps and the required number of fire hose nozzles;
- .2** the drainage system valves shall be operable from outside the protected space at a position in the vicinity of the fire-extinguishing system controls;
- .3** bilge wells shall be of sufficient holding capacity and shall 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, the adverse effect upon stability of the added weight and free surface of water shall be taken into account and calculations shall be submitted confirming that after flooding the cargo space the ship will comply with the requirements of *Part IV – Stability and Subdivision*.

**2.10.3.3.4** The total required capacity of the water supply shall satisfy the requirements specified in 2.10.3.2 and 2.10.3.3, if applicable, simultaneously calculated for the largest designated cargo space.

The capacity requirements, specified in 2.10.3.2., shall be met by the total capacity of the main fire pump(s), not including the capacity of the emergency fire pump, if fitted. If water-spraying fire-extinguishing system is used to satisfy the requirements of 2.10.3.3, the spraying system pump shall be also taken into account in this total capacity calculations.

#### **2.10.3.4 Cooling the Cargo Space with Other Suitable Medium**

In lieu of spraying or flooding a designated under deck space, provision to flood the space with suitable specified medium<sup>1)</sup>, may be made.

#### **2.10.4 Sources of Ignition**

**2.10.4.1** Electrical equipment and wiring shall not be fitted in enclosed cargo spaces, as well as in closed and open ro-ro spaces unless it is essential for operational purposes.

**2.10.4.2** However, if electrical equipment is fitted in such spaces, it shall be of a certified safe type for use in the dangerous environments to which it may be exposed<sup>2)</sup>, unless it is possible to completely isolate the electrical system (e.g. by removal of links in the system, other than fuses).

**2.10.4.3** Cable penetrations of the decks and bulkheads shall be sealed against the passage of gas or vapours. Through runs of cables and cables within the cargo spaces shall be protected against damage from impact.

**2.10.4.4** Any other equipment which may constitute a source of ignition of flammable vapours shall not be permitted.

#### **2.10.5 Fire Detection and Fire Alarm System**

**2.10.5.1** Ro-ro spaces shall be fitted with a fixed fire detection and fire alarm system complying with the requirements of 4.1. All other types of cargo spaces shall be fitted with either a fixed fire detection and fire alarm system or a sample extraction smoke detection system complying with the requirements of 4.1 or 4.2. If a sample extraction smoke detection system is fitted, attention shall be paid to prevent the leakage of toxic fumes and flammable gases into adjacent occupied areas.

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<sup>1)</sup> A fixed high expansion foam system, complying with the requirements of 3.5.3, is acceptable, except if cargoes dangerously react with water (see the *IMDG Code*).

<sup>2)</sup> The electrical equipment shall comply with the requirements of Publication IEC 60092, Part 506.

**2.10.5.2** If a cargo space or the weather deck is intended for the carriage of class 1 goods, it is recommended to monitor adjacent cargo spaces, with the exception of open ro-ro spaces, by a fixed fire detection and fire alarm system or a sample extraction smoke detection system, complying with the requirements specified in 4.1 or 4.2.

## **2.10.6 Ventilation**

### **2.10.6.1 Mechanical Ventilation (six air exchanges per hour)**

**2.10.6.1.1** Enclosed cargo spaces<sup>1)</sup> shall be provided with adequate power ventilation. The ventilation shall provide for at least six air changes per hour in the cargo space, based on empty cargo space and for removal of gases and vapours from the upper or lower parts of the cargo space, as appropriate.

**2.10.6.1.2** The requirement concerning the removal of gases and vapours from the upper and lower part of the cargo hold is considered to be met if the ducting is arranged such that approximately 1/3 of the air volume is removed from the upper part and 2/3 from the lower part. The position of air inlets and air outlets shall be such as to prevent short circuiting of the air. Interconnection of the hold atmosphere with other spaces is not permitted.

In cargo spaces intended for the carriage of solid dangerous cargoes in bulk, the ducting shall be so arranged that the space above the cargo can be ventilated and that exchange of air from outside to inside the entire cargo space is provided.

**2.10.6.1.3** For open top container ships, mechanical ventilation is required only for the lower part of the cargo hold (for which purpose ducting is required). The ventilation capacity shall be at least 2 air changes per hour based on the empty hold volume below weather deck.

**2.10.6.1.4** Where continuous ventilation is required, fixed ventilator(s) shall be fitted. Portable ventilators are permitted, provided they are permanently fixed during loading and voyage.

In the case of the carriage of cargoes which require continuous ventilation<sup>2)</sup>, it is not prohibited to use ventilators fitted with a means of closure required for fire

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<sup>1)</sup> If adjacent spaces are not separated from cargo spaces by gastight bulkheads or decks, then they are considered as part of the enclosed cargo space and the ventilation requirements that apply to the adjacent space shall be the same as those applicable to the enclosed cargo space itself.

<sup>2)</sup> Under the *IMSBC Code*, continuous ventilation is required in cargo spaces carrying the following solid cargoes in bulk:

ALUMINIUM FERROSILICON POWDER UN 1395;

ALUMINIUM SILICON POWDER, UNCOATED UN 1398;

ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS UN 3170;

FERROPHOSPHORUS (including BRIQUETTES);

FERROSILICON ( $25\% \leq \text{Silicon} \leq 30\%$  or  $\geq 90\%$  Silicon);

FERROSILICON UN 1408 ( $30\% \leq \text{Silicon} < 90\%$ );

ZINK ASHES UN 1435.

protection purposes, provided the minimum height to the ventilator opening is in accordance with the international Convention on Load Lines (ICLL), reg.19.3.

**2.10.6.1.5** Where the *IMSBC Code* requires 2 fans per hold, a common ventilation system with 2 fans connected is acceptable.

### **2.10.6.2 Non-Sparking Fans**

**2.10.6.2.1** The fans shall be such as to avoid the possibility of ignition of flammable gas/air mixtures.

Exhaust fans shall be of non-sparking type and shall comply with the requirements specified in sub-chapter 5.3.2, *Part VII – Machinery, Boilers and Pressure Vessels*.

**2.10.6.2.2** Suitable wire mesh guards shall be provided over inlet and outlet openings to prevent foreign objects from entering into the fan casing. The standard wire mesh guards should have a size of 13 mm x 13 mm.

**2.10.6.2.3** The air outlets shall be placed at a safe distance from possible ignition sources. A spherical radius of 3 m around the air outlets, within which ignition sources are prohibited, is required.

### **2.10.6.3 Natural Ventilation (Carriage of Solid Dangerous Goods in Bulk)**

Natural ventilation, with ventilator closures, shall be provided in enclosed cargo spaces intended for the carriage of solid dangerous goods in bulk, where there is no provision for mechanical ventilation.

### **2.10.7 Bilge Pumping**

**2.10.7.1** Where it is intended to carry flammable or toxic gases in enclosed spaces, the bilge pumping shall be designed to protect against inadvertent pumping of such liquids through machinery spaces piping or pumps. Where large quantities of such liquids are carried, additional means of draining those spaces shall be provided.

Bilge systems for cargo holds on container ships shall be independent of the machinery space bilge system. The system bilge pump shall be located outside the machinery space.

**2.10.7.2** If the bilge drainage system is additional to the system served by pumps in the machinery space, the capacity of the system shall be not less than 10 m<sup>3</sup>/h per cargo space served. If the additional system is common and serves more than 2 cargo spaces, the capacity need not exceed 25 m<sup>3</sup>/h. The additional bilge system need not be arranged with redundancy.

The additional bilge system shall enable any leaked flammable or toxic liquids to be removed from all bilge wells in the cargo space.

Pumps and pipelines serving the system shall not be installed in machinery spaces.

Where water-driven ejectors are installed, they shall be equipped, on the suction side, with non-return valves.

**2.10.7.3** The bilge pipeline into the machinery space shall be isolated either by fitting a blank flange or by a closed lockable valve. The isolating valve shall be situated outside the machinery space, at the point of exit from the machinery space close to the bulkhead.

Warning sign shall be displayed at the isolating valve or control positions, bearing the inscription: **THIS VALVE SHALL BE KEPT SECURED IN CLOSED POSITION DURING THE CARRIAGE OF DANGEROUS GOODS IN CARGO HOLD NO. ....**

**2.10.7.4** Enclosed spaces outside machinery spaces<sup>1)</sup> containing bilge pumps serving cargo spaces intended for the carriage of flammable or toxic liquids shall be fitted with separate mechanical ventilation giving at least six air changes per hour. If the space has access from another enclosed space the door shall be self-closing.

**2.10.7.5** If bilge draining of cargo spaces is arranged by gravity drainage, the drainage shall be either led directly overboard or to a closed drain tank located outside the machinery spaces. The tank shall 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.

## **2.10.8 Personnel Protection**

**2.10.8.1** The ship shall be provided with four sets of chemical protective clothing, in addition to the required fire-fighter's outfits. The chemical protective clothing shall cover all skin so that no part of the body is unprotected.

The chemical protective clothing is intended for emergency purposes only.

The chemical protective clothing shall be selected taking account of the hazards related to the carried cargoes (chemicals) and IMO-developed standards for the particular classes of cargo and physical condition.

For solid bulk cargoes, the protective clothing shall satisfy the equipment provisions specified in the respective schedules of the *IMSBC Code* for individual substances.

For packaged goods, the protective clothing shall satisfy the equipment provisions specified in emergency procedures (EmS) of the *Supplement* to the *IMDG Code* for individual substances.

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<sup>1)</sup> Electrical equipment in such space shall comply with IEC Publication 60092 and the requirements of *Part VIII – Electrical Installations and Control Systems*.



**2.10.8.2** The ship shall be provided with at least two additional self-contained breathing apparatuses complying with the requirements specified in 5.1.4.

For each of the breathing apparatus, two complete sets of air bottles shall be provided. These spare bottles shall be in addition to the spare bottles required for fireman's outfit. Ships equipped with means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus.

### **2.10.9 Portable Fire-Extinguishers**

The cargo spaces shall be provided with portable fire-extinguishers with a total capacity of at least 12 kg of dry powder or equivalent (e.g. two 6 kg dry powder extinguishers), located at the entrance to these spaces. These extinguishers shall be in addition to any portable fire-extinguishers required by the *Rules*.

### **2.10.10 Insulation of Machinery Space Boundaries**

**2.10.10.1** Bulkheads forming boundaries between cargo spaces (conventional cargo spaces) and machinery spaces of category A shall also be insulated to A-60 Class standard, unless the dangerous goods are stowed at least 3 m horizontally away from such bulkheads. Other boundaries (e.g. decks) between such spaces shall be insulated to A-60 Class standard.

**2.10.10.2** In the case that a closed or semi-closed cargo space is located partly above a machinery space and the deck above the machinery space is not insulated to A-60 Class standard, dangerous goods are prohibited in the whole of that cargo space. If the deck above the machinery space is a weather deck, not insulated to A-60 Class standard, dangerous goods are prohibited only for the portion of the deck located above the machinery space.

### **2.10.11 Water-Spraying System in Ro-Ro Spaces**

**2.10.11.1** 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 shall be fitted with a fixed pressure water-spraying system, complying with the requirements specified in 3.4.2 or equivalent high pressure water-based fire-extinguishing system, referred to in 3.4.3. The system shall be manually operated and shall protect all parts of any deck and vehicle platform in the space.

**2.10.11.2** To prevent the build-up of free surfaces, the draining system, complying with the requirements specified in 2.10.3.3.3, shall be fitted.

### **2.10.12 Separation of Ro-Ro Spaces**

**2.10.12.1** In ships having ro-ro spaces, a separation shall be provided between a closed ro-ro space and an adjacent open ro-ro space. The separation shall be such as to minimize the passage of dangerous vapours and liquids between such spaces.

Such separation need not be provided if the ro-ro space is considered to be a closed cargo space over its entire length.

**2.10.12.2** In ships having ro-ro spaces, a separation shall be provided between a closed ro-ro space and the adjacent weather deck. The separation shall be such as to minimize the passage of dangerous vapours and liquids between such spaces. 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 decks.

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### 3 FIRE-EXTINGUISHING SYSTEMS AND INERT GAS SYSTEMS

Fire-extinguishing systems are intended for the extinction of fire inside the ship spaces or on the open deck.

Inert gas systems are intended for rendering and maintaining atmosphere in cargo tanks and hull spaces in tankers.

#### 3.1 General Requirements

**3.1.1** Fire-extinguishing systems and inert gas systems shall be so constructed as to be efficient and readily available for operation under all conditions specified in sub-chapter 1.6, *Part VI – Machinery Installations and Refrigerating Plants*.

**3.1.2** Fire-extinguishing medium storage vessels and cylinders used in fire-extinguishing systems and inert gas systems shall comply with the requirements for pressure vessels and air receivers, specified in Chapter 12, *Part VII – Machinery, Boilers and Pressure Vessels*.

**3.1.3** Pumps other than those serving the water fire main system necessary for the supply of water to fire-extinguishing systems for the protection of the ship's spaces, required by the present Part of the *Rules*, their sources of power and their controls shall be installed outside the spaces protected by such systems and shall be so arranged that a fire in the spaces will not put any such system out of action.

**3.1.4** The use of fire-extinguishing media, which, either by themselves or under expected conditions of use, emit toxic gases in such quantities as to endanger persons, is not permitted.

**3.1.5** In fire-extinguishing systems and in inert gas systems, metal pipes of the minimum melting temperature appropriate for the given extinguishing system, shall be used. Steel pipes, except stainless steel pipes, shall be protected against corrosion; it is recommended that steel pipes should be hot-galvanized both inside and outside.

**3.1.6** Plastic pipes are allowed for the following fire-extinguishing systems:

- water fire main systems,
- water-spraying systems,
- foam systems,
- sprinkler systems

used in ship spaces/areas if they were subjected to fire tests in accordance with *Publication No. 53/P* (Res. A.753(18) and Res. 313(88)), having due regard to their location, as specified in Table 4.1.3 of the said *Publication*.

**3.1.7** Fire-extinguishing systems and inert gas systems pipes shall comply with the requirements specified in sub-chapter 1.16, *Part VI – Machinery Installations and Refrigerating Plants*, as follows:

- materials for pipes – the requirements of sub-chapter 1.16.2;
- pipe wall thickness – the requirements of sub-chapter 1.16.3;
- pipe connections – the requirements of sub-chapter 1.16.4;
- pipe bends radius – the requirements of sub-chapter 1.16.5;
- protection against corrosion – the requirements of sub-chapter 1.16.7;
- pipes insulation – the requirements of sub-chapter 1.16.8;
- pipes passage and penetrations – the requirements of sub-chapter 1.16.11;
- flexible hose assemblies and compensators – the requirements of sub-chapter 1.16.12.

**3.1.8** Continuously pressurized pipelines installed outside ship spaces or in non-heated spaces shall be so designed or protected as to preclude their freezing in ship operation areas where low temperatures may exist.

## 3.2 Water Fire Main System

All self-propelled ships shall be provided with water fire main system complying with the requirements of the present sub-chapter.

### 3.2.1 Number, Capacity and Discharge Pressure of Fire Pumps

**3.2.1.1** For ships other than passenger ships, the number of the main fire pumps and the minimum pressure of water supplied simultaneously by all the pumps and the two required nozzles at the discharge rate determined in 3.2.1.5, at any hydrant, shall be in compliance with the values given in Table 3.2.1.1. For passenger ships – see 6.1.16.2.

**3.2.1.2** The maximum pressure at any hydrant shall not exceed that at which the effective control of a fire hose by one person is possible. This shall be checked during the acceptance of the system on board.

**Table 3.2.1.1**

Ships other than passenger ships, gross tonnage	Number of fire pumps	Minimum pressure at hydrants [MPa]
< 500	1 (plus portable pump, required for cargo ships)	*
500 ≤ gross tonnage < 6000	2	0.25
≥ 6000	2	0.27

\* In ships of 150 gross tonnage and upwards, the pressure of the fire pump shall be sufficient to ensure delivering, through fire hose nozzles adopted on the ship, a jet of water of at least 12 m throw length; in ships of less than 150 gross tonnage – the length of the water jet may be appropriately less.

**3.2.1.3** Every cargo ship of 500 gross tonnage and upwards shall be additionally fitted with an emergency fire pump complying with the requirements of 3.2.4.

**3.2.1.4** Unless the two main fire pumps, their sea valves and their sources of power are situated within compartments separated by at least A-0 Class divisions so that a fire in any one compartment will not render both fire pumps inoperable, an emergency fire pump should be fitted. In such case one of the fire pumps shall comply with the requirements for the emergency fire pump, specified in 3.2.4.

An arrangement in which one main fire pump is located within a compartment having more than one bulkhead or deck adjacent to the compartment containing the other main fire pump should also require an emergency fire pump.

**3.2.1.5** On cargo ships, the total capacity of the main fire pumps (excluding the emergency fire pump), with a pressure not lower than that specified in Table 3.2.1.1, shall be not less than four-thirds of the capacity of each required bilge pump, specified in paragraph 6.1.3, *Part VI – Machinery Installations and Refrigerating Plants*.

On cargo ships, the total capacity of the main fire pumps need not exceed 180 m<sup>3</sup>/h, unless a larger capacity is required in order to ensure the simultaneous operation of other fire-extinguishing systems supplied by the pumps.

**3.2.1.6** In every ship which is required to be provided with more than one fire pump, each of the required fire pumps, other than the emergency pump, shall have a capacity not less than 80% of the total required capacity divided by the minimum number of the required fire pumps but in any case not less than 25 m<sup>3</sup>/h. Each such pump shall be capable of supplying at least two jets of water – see the assumptions for capacity calculations given in 3.2.4.2.2. These fire pumps shall be capable of supplying the fire main system under the required conditions.

Where more than the minimum of the required pumps are installed, such additional pumps shall have a capacity of at least 25 m<sup>3</sup>/h and shall be capable of delivering at least two jets of water.

**3.2.1.7** Where other fire-extinguishing systems using water from fire pumps are provided in the ship, the capacity of such pumps shall be sufficient for the operation of the water fire main system with at least 50% of capacity determined in 3.2.1.5 and for simultaneous operation of one of the other systems which requires the largest quantity of water. In cargo ships, the capacity of fire pump required for simultaneous provision of water for other fire-extinguishing systems shall be sufficient for delivering at least 2 jets of water through nozzles of the largest size used in the ship.

**3.2.1.8** The location of each main and emergency fire pumps shall be indicated by a plate with the symbol used on *Fire Control Plan*.

### 3.2.2 Ready Availability of Water Supply

**3.2.2.1** In cargo ships of gross tonnage 500 and upwards, provision shall be made for a remote starting of one of the fire pumps from the fire control station, located outside the machinery space or from control station. In the pump remote starting position, a gauge indicating water pressure or another indicator (e.g. an electric lamp) shall be provided to indicate the pump operation.

The location of a remote starting of the fire pump shall be indicated by a plate with the symbol used on *Fire Control Plan*.

The remote starting arrangement of the pumps need not be provided in the case of permanently pressurized water fire main system with automatic starting of the pump.

Ships with periodically unattended machinery space and where only one person is required on watch shall comply with the requirements specified in 6.16.1.

**3.2.2.2** For dry pipe (not filled with water) water fire main systems, the time from starting the pump till the moment the water is supplied to the remotest fire hydrant located within accommodation area shall not exceed 1 min. For fire hydrants located in cargo area, this period of time may be appropriately longer. The above shall be checked during the acceptance of the water fire main system on board.

### 3.2.3 Requirements for Fire Pumps

**3.2.3.1** Fire pumps shall be independently driven. In ships of less than 1000 gross tonnage, one of the required fire pumps may be driven from the main engine.

**3.2.3.2** Fire pumps may be used for other shipboard services if the ship is provided with at least two independently driven fire pumps, one of which is all the time kept readily available for water supply to the water fire main system.

**3.2.3.3** Sanitary, ballast, bilge or general service pumps may be accepted as main fire pumps, provided that their capacity and pressure head comply with the requirements for fire pumps and that such pumps are not used for pumping liquid fuel or oil.

**3.2.3.4** On cargo ships, in which ballast, bilge or general service pumps are installed in machinery spaces, it is additionally required for at least one such pump with at least 25 m<sup>3</sup>/h capacity and the water pressure specified in 3.2.1.1 to be capable of supplying sea water to the water fire main system.

However, it is not required to choose pumps with capacity and pressure characteristics other than being optimal for the service intended just to make connection to the fire main possible, provided the required number and capacity of fire pumps are ensured.

**3.2.3.5** Each electrically driven fire pump shall be provided with the pump start button, located in an easily accessible position. Location of the button shall be indicated by a plate with the symbol used on *Fire Control Plan*. Overload protection

of electric drives shall comply with the requirements specified in 8.3.3, *Part VIII – Electrical Installations and Control Systems*.

**3.2.3.6** Pumps which are capable of developing a pressure exceeding the design pressure shall be provided with relief valves. Those valves shall be so placed and adjusted as to prevent excessive pressure in any part of the system.

**3.2.3.7** Fire pumps and their sea valves shall be located below the ship summer load waterline to ensure water suction under all trim, roll and heeling conditions. If such arrangement is not practicable, the pumps shall be self-priming.

**3.2.3.8** At least one of the fire pumps located in the machinery space shall be supplied from two sea chests.

**3.2.3.9** Fire pumps installed outside the machinery space shall have sea valves in each compartment in which they are situated.

**3.2.3.10** Fire pumps and their prime movers shall not be installed forward of the collision bulkhead.

**3.2.3.11** Each fire pump shall be provided with shut-off valves on the suction and discharge side, as well as a pressure gauge. In the case of centrifugal fire pumps, non-return valves, preventing water backflow, shall be fitted on the discharge side.

**3.2.3.12** The sea valves, as well as shut-off valves shall be provided with a plate bearing the inscription: THE VALVE SHALL BE ALWAYS KEPT OPEN.

## **3.2.4 Fixed Emergency Fire Pump**

### **3.2.4.1 General Requirements**

**3.2.4.1.1** The emergency fire pump shall be a fixed independently driven pump, powered by diesel engine or an electric motor supplied from an emergency source of power.

**3.2.4.1.2** The emergency fire pump, its sea valve, suction and delivery pipes and isolating valves shall be located outside the machinery space, in which the main fire pumps and/or sources of power are located.

If this arrangement cannot be made, the sea valve may be fitted in the machinery space, provided the valve is remotely controlled from a position in the same compartment in which the emergency pump is located and the suction pipe is as short as practicable.

**3.2.4.1.3** Short lengths of suction and discharge pipes of the emergency fire pump may penetrate the above-mentioned machinery space, provided they are

enclosed in a substantial steel casing or are insulated to A-60 Class standard. The pipes shall have substantial wall thickness, but in no case less than 11 mm and shall be welded, except for the flanged connection to the sea inlet valve.

**3.2.4.1.4** In the case where suction or discharge pipes penetrating machinery spaces are enclosed in a substantial casing, or are insulated to A-60 class standard, it is not necessary to enclose or insulate distance pieces, sea inlet valves and sea chests. For this purpose, the discharge piping means piping between the emergency fire pump and the isolating valve. The method for insulating pipes to A-60 Class standard is that they shall be covered/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*.

**3.2.4.1.5** Where the sea inlet valve is in the machinery space, the valve should not be a fail-close type. Where the sea inlet valve is in the machinery space and is not a fail-open type, measures shall be taken so that the valve can be opened in the event of fire, e.g. control piping, actuating devices and/or electric cables with fire-resistant protection equivalent to A-60 Class standard.

**3.2.4.1.6** Where the main fire pumps are provided in compartments outside machinery spaces and the emergency fire pump suction or discharge piping penetrates such compartments, the piping shall comply with the requirements specified in 3.2.4.1.3 and 3.2.4.1.4.

**3.2.4.1.7** Where the emergency fire pump is driven by electric engine, the electrical cables to this pump shall not pass through the machinery spaces containing the main fire pumps and/or their sources of power, as well as through other spaces or areas of high fire risk.

Where the ship arrangements are such that the cables have to pass through these spaces, the cables shall be of a fire-resistant type complying with the requirements of 16.1.3, *Part VIII – Electrical Installations and Control Systems* and shall be specially protected against mechanical damage, e.g. run in heavy gauge pipe.

**3.2.4.1.8** Control post of the emergency fire pump shall be located outside the main fire pumps space, in close vicinity to the pump, as well as in the place of the pump sea valve control if the valve is controlled from outside the emergency fire pump-room.

The location of a remote starting of the emergency fire pump shall be indicated by a plate with the symbol used on *Fire Control Plan*.

### **3.2.4.2 Capacity and Discharge Pressure of the Emergency Fire Pump**

**3.2.4.2.1** The capacity of the emergency fire pump cannot be less than 40% of fire pumps capacity required in 3.2.1.5 and in no case less than:

- .1 25 m<sup>3</sup>/h – for cargo ships of 2000 gross tonnage and upwards;



- .2 15 m<sup>3</sup>/h – for cargo ships of less than 2000 gross tonnage.

When the pump is delivering the quantity of water required above, the pressure at any hydrants shall be not less than that specified in 3.2.1.1.

On cargo ships of 500 gross tonnage and upwards, engaged on international voyages, the pressure shall not be less than 0.27 MPa.

**3.2.4.2.2** Where a fixed water-spraying fire-extinguishing system or water-based fire-extinguishing system installed for the protection of the machinery space of category A, required in 2.5.1.1, is supplied by the emergency fire pump, then the emergency fire pump capacity shall be adequate to supply the fixed fire-extinguishing system at the required pressure plus two jets of water. The capacity of the two jets shall in any case be calculated as not less than 25 m<sup>3</sup>/h, at the assumption that both jets are supplied by nozzles of the maximum diameter<sup>1)</sup>.

It is assumed that the capacity of a single jet at the hydrant pressure of 0.27 MPa is 16 m<sup>3</sup>/h – for the nozzle diameter 16 mm, and 23.5 m<sup>3</sup>/h – for the nozzle diameter 19 mm.

### **3.2.4.3 Sea Inlet Valve and the Emergency Fire Pump Suction Height**

**3.2.4.3.1** The sea inlet valve for the pump shall be installed below the summer load waterline so that the pump will be capable of pumping under all conditions of list, trim, roll and pitch likely to be encountered in service.

**3.2.4.3.2** Where necessary to ensure suction, the emergency fire pump shall be of self-priming type. The total suction head and the net positive suction head of the pump shall be such as to ensure the required pump capacity and the hydrants pressure under all conditions of list, trim, roll and pitch to be encountered in service. The ballast condition of a ship on entering or leaving a dry dock need not be considered as service condition.

**3.2.4.3.3** It shall be indicated, in classification documentation, that the emergency fire pump suction inlet is fully submerged under all conditions of list, trim, roll and pitch likely to be encountered in service.

**3.2.4.3.4** Operational sea-going conditions for which roll, pitch and heave shall be applied are as follows:

- .1 the lightest sea-going condition shall be considered, which is defined as the ballast condition which gives the shallowest draught at the position of the sea chest and emergency fire pump as given in the approved stability booklet (or preliminary stability calculation for new building);
- .2 for the calculation of roll, pitch and heave, the table given in MSC.1/Circ.1388, shall be applied;

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<sup>1)</sup> When selecting the biggest nozzle size available onboard, the nozzles located in the space containing fire pumps need not be taken into account.

- .3 the heave combined with pitch and heave combined with roll shall be considered separately.

**3.2.4.3.5** The emergency fire pump suction shall be submerged at the waterlines corresponding to the two following conditions:

- .1 a static waterline drawn through the level of 2/3 immersion of the propeller at even keel (pod or thruster driven ships shall be considered separately); and
- .2 the ship in the arrival ballast condition, in accordance with the approved trim and stability booklet, without cargo and with 10% stores and fuel remaining.

For either condition, roll, pitch and heave need not be applied.

**3.2.4.3.6** Restricted service ships (ships operating solely in sheltered waters) shall be subject to compliance with the still water submergence requirement specified in 3.2.4.3.5.1.

**3.2.4.3.7** In all cases, the net positive suction head (NPSH) available for the pump shall be greater than that required in the present sub-chapter.

**3.2.4.3.8** Upon completion of the emergency fire pump installation, a performance test confirming the pump capacity, which is to be not less than that required in 3.2.4.2.1, shall be carried out. If the emergency fire pump is the main supply of water for any fixed fire-extinguishing system provided to protect the space where the main fire pump is located, the pump shall have the capacity for this system. As far as practicable, the test shall be carried out at the draught corresponding to the lightest sea-going condition.

#### **3.2.4.4 Emergency Fire Pump Space**

**3.2.4.4.1** The space containing the emergency fire pump shall 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 shall have the fire integrity as specified in 2.2.2 for a control station.

When a single access to the emergency fire pump room is through another space adjoining a machinery space of category A or the spaces containing the main fire pumps, Class A-60 boundary is required between that other space and the machinery space of category A or the spaces containing the main fire pumps.

**3.2.4.4.2** No direct access shall be permitted between the machinery space of category A or machinery space containing the main fire pumps and the space containing the emergency fire pump and its source of power. When this is not practicable, an arrangement where the access is by means of an airlock with the door of the machinery space being of A-60 Class standard and the other door being

steel, gastight, self-closing and without any hold-back arrangements, may be permitted.

Alternatively, the access may be through a watertight door capable of being remotely operated from a readily accessible position outside 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 (e.g. through a manhole and ladder) shall be provided.

**3.2.4.4.3** The room containing the emergency fire pump and its sources of power shall have adequate space for maintenance work and inspections.

**3.2.4.4.4** The room, referred to above, shall be provided with lighting, supplied from the emergency source of electric power.

**3.2.4.4.5** The room containing the emergency fire pump and its sources of power shall be well ventilated. If mechanical ventilation, necessary for diesel engine operation, has been provided, it shall be supplied from the emergency source of electric power.

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

### **3.2.4.5 Diesel Engine and Fuel Tank for Emergency Fire Pump**

**3.2.4.5.1** The emergency fire pump shall be driven by a diesel engine only. The engine shall be capable of being readily started in its cold condition down to the temperature of 0 °C by hand (manual) cranking. 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 shall be fitted. If hand (manual) starting is impracticable, compressed air, electricity, or other sources of stored energy, including hydraulic power or starting cartridges are permitted to be used as a means of starting.

The means shall be such as to enable the diesel-driven power source to be started at least six times within a period of 30 minutes and a least twice within the first 10 minutes.

**3.2.4.5.2** A service fuel tank of the volume sufficient to ensure at least 3-hours operation of the pump on full load shall be installed in the space containing the emergency fire pump. The fuel reserve sufficient to ensure an additional 15-hours operation of the pump shall be provided outside the machinery space of category A.

**3.2.4.5.3** The minimum level/ the required minimum volume of fuel shall be marked on the service fuel tank.

### **3.2.5 Water Fire Main Pipings**

**3.2.5.1** The diameter of the water fire main system pipes shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously. In the case of cargo ships, the diameter need only be sufficient for the discharge of 140 m<sup>3</sup>/hour.

For cargo ships of 500 gross tonnage and upwards, the water fire main system pipes shall be calculated for a working pressure not less than 1.0 MPa.

**3.2.5.2** The pipelines and fire hydrants shall be so designed and arranged as to preclude their freezing in ships entering areas where low temperatures may exist. It applies, in particular, to continuously pressurized pipelines.

For continuously pressurized pipelines where fire hydrants are located on open decks, it is recommended that supply pipes installed in interior locations should be fitted with shut-off valves, remotely controlled from a position near the hydrant. The pipeline section from a shut-off valve to the hydrant, subjected to freezing, shall be drained by means of a drain plug. The fire hydrant and the drain plug shall be provided with a plate informing on the necessity of draining this pipe section after it has been used.

**3.2.5.3** The whole section of the fire main within machinery space of category A containing the main fire pump(s) shall be separated by isolating valves from the rest of the fire main. The isolating valves shall be installed in an easily accessible position outside the machinery space. The fire main shall 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 pump or the emergency fire pump.

Each section of water fire installation pipings installed within machinery space of category A shall be additionally equipped with the isolating valve located outside the space.

This requirement is not applicable to the piping supplied by fire pumps located in spaces other than machinery spaces of category A.

The location of each isolating valve separating the section of the fire main shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.2.5.4** Materials made readily rendered ineffective by heat shall not be used for fire mains and hydrants unless adequately protected.

**3.2.5.5** Fire main pipelines shall be capable of being drained through drain plugs fitted in the lowest section of the system.

**3.2.5.6** Each open deck fire main branch used for the purpose other than fire-fighting shall be fitted with an isolating valve. This valve shall be remotely controlled from the open deck.

### **3.2.6 Fire Hydrants**

**3.2.6.1** Each fire hydrant shall be fitted with a coupling complying with national standards and a shut-off valve so that any fire hose may be connected and removed while the pump is in operation.

Fire hydrant couplings, installed on open decks, shall be provided with easily removable caps.

**3.2.6.2** Fire hydrants shall be so positioned that they allow easy and rapid connection of fire hoses.

**3.2.6.3** The number and position of hydrants shall be such that at least two jets of water not emanating from the same hydrant, one of which shall 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 cargo space or any special category space in which latter case the two jets of water shall reach any part of the space, each from a single length of hose. For ro-ro spaces and vehicle spaces – the requirements are specified in 6.2.2.3.

Fire hydrants shall be positioned near the accesses to the protected spaces.

The location of each fire hydrant shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.2.6.4** In ships where deck cargo may be carried, the positions of the hydrants shall be such that they are always readily accessible and the pipes are arranged as far as practicable to avoid risk of damage by such cargo.

**3.2.6.5** In machinery spaces of category A, there shall be at least two fire hydrants with fire hose and nozzle located on either side of the ship. In small machinery spaces, only one fire hydrant is permitted.

In cargo ships of less than 500 gross tonnage where the machinery space of category A cannot afford the connection and use of fire hose inside the space, the fire hydrant, together with fire hose and nozzle may be located outside the machinery space, close to the entrance to this space.

**3.2.6.6** Fire hydrants shall be made from material resistant to the corrosive effect of sea water.

**3.2.6.7** Fire hydrants shall be painted red.

### **3.2.7 Fire Hoses**

**3.2.7.1** Fire hoses shall be of non-perishable material and shall 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 fire hose shall be provided with a nozzle and the necessary couplings allowing quick connection.

Fire hose couplings shall be made from material resistant to the corrosive effect of sea water.

Fire hoses shall be made in accordance with EN 694:2001. They are subject to tests in accordance with PN-EN 14540 + A1.

**3.2.7.2** Fire hoses, together with nozzles and any necessary fittings and tools, shall be stowed in hose boxes, located in conspicuous positions near the water service hydrants or connections.

Within accommodation spaces, fire hoses shall be stowed in boxes, on reels and shall be permanently connected to fire hydrants.

Fire hoses boxes shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.2.7.3** Fire hoses shall have a length of at least 10 m, but not more than:

- .1 15 m in machinery spaces;
- .2 20 m in superstructure spaces and on open decks;
- .3 25 m on open decks in ships with a maximum breadth in excess of 30 m.  
In ships of less than 500 gross tonnage, the length of fire hose shall not exceed:
- .4 10 m in machinery spaces;
- .5 18 m in superstructure spaces and on open decks.

**3.2.7.4** Unless one fire hose and nozzle is provided for each fire hydrant in the ship, there shall be complete interchangeability of hose couplings and nozzles.

**3.2.7.5** In cargo ships of 1000 gross tonnage and upwards, the number of fire hoses to be provided shall 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 fire hoses required in machinery spaces and boiler rooms.

**3.2.7.6** In cargo ships of less than 1000 gross tonnage, the number of fire hoses to be provided shall be calculated in accordance with 3.2.7.5; the number of fire hoses shall in no case be less than three.

**3.2.7.7** In every cargo ship, the number of fire hoses shall be not less than the number of provided fire hydrants.

### **3.2.8 Fire Hose Nozzles**

**3.2.8.1** Fire hose nozzles shall be made from material resistant to the corrosive effect of sea water. Fire hose nozzles made of plastic material, e.g. polycarbonate, are considered acceptable, provided the nozzles capacity and serviceability, as well as their suitability for the marine environment are confirmed by tests.

**3.2.8.2** Standard nozzle sizes 12 mm, 16 mm or 19 mm or as near thereto as possible shall be used on ships. Where other fire-extinguishing systems are used – such as fog fire-extinguishing systems – different diameter nozzles may be permitted.

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

**3.2.8.4** For machinery spaces and open decks, the nozzle size shall be such as to obtain the maximum discharge possible from two jets of water at the pressure specified in Table 3.2.1.1 from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.

**3.2.8.5** All fire hose nozzles shall be of approved dual-purpose type, i.e. of spray/jet type incorporating a shutoff.

### **3.2.9 International Shore Connection**

**3.2.9.1** In ships of gross tonnage 2000 and above, the fire main system shall have a branch led to the open deck in way of superstructure. The branch shall be fitted with a permanent shore connection for the water supply. The shore connection shall be fitted with a shut-off valve, as well as steel coupling for the international shore connection in accordance with the requirements specified in Table 2.1 of the *FSS Code*. The shut-off valve is not required if the shore connection is closed with a blind flange fitted with butterfly screws (not requiring a wrench to remove the flange).

**3.2.9.2** Facilities shall be available enabling such pipe connection to be used on either side of the ship.

**3.2.9.3** All ships of 500 gross tonnage and upwards and passenger ships engaged on international voyages shall be provided with a portable international shore connection complying with the requirements specified in Chapter 2 of the *FSS Code*.

**3.2.9.4** Facilities shall be available enabling such shore connection to be used on each side of the ship.

**3.2.9.5** The portable international shore connection shall be kept in a fire store-room. The location of international shore connection shall be indicated by a plate with the symbol used on *Fire Control Plan*.

## **3.3 Automatic Sprinkler System (for the Protection of Accommodation Spaces, Service Spaces and Control Stations)**

### **3.3.1 General Requirements**

**3.3.1.1** An automatic sprinkler system shall be fitted with sea water pump, a pressure tank with an arrangement, control panels with alarm system, pipelines grouped in sections with section valves supplying water to spaces and the sprinklers. The sprinkler system shall be automatically set in operation at the temperature in the protected space rise to the value given in 3.3.7.2.

**3.3.1.2** The system pipings shall be always filled with fresh water, but small exposed sections may be of the dry type <sup>1)</sup> where this is a necessary precaution.

Saunas and refrigerated provision chambers shall be fitted with dry pipe sprinkler systems.

In control stations, in which water may cause damage to essential, for the safety of the ship, appliances, dry-type pipes may also be used.

**3.3.1.3** Any part of the system which may be subjected to freezing temperatures in service shall be suitably protected against freezing.

**3.3.1.4** Automatic sprinkler system shall be capable of immediate operation at all times and no action of the crew shall be necessary to set it in operation.

**3.3.1.5** The sprinkler system shall be kept charged at the necessary pressure and shall have provision for a continuous supply of water.

**3.3.1.6** Spaces/group of spaces protected by automatic sprinkler system shall be indicated by a plate, placed on access door, with the symbol used on *Fire Control Plan*.

### **3.3.2 Sources of Power Supply**

**3.3.2.1** There shall be not less than two sources of power supply for the sea water pump and alarm system. If the pump is electrically driven, it shall be connected to the main electric switchboard, which shall be capable of being supplied by at least two generators.

**3.3.2.2** The power supply lines shall be so arranged as to avoid galleys, machinery spaces and other enclosed spaces of high fire risk, except in so far as it is necessary to reach the appropriate switchboards.

**3.3.2.3** One of the sources of power supply for the alarm system shall be an emergency source of electric power.

**3.3.2.4** Where one of the sources of power for the sea water pump is an internal combustion engine, it shall, in addition to compliance with the requirements of 3.3.4.5, be so situated that a fire in any protected space will not affect the air supply to the engine.

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<sup>1)</sup> Dry-type pipes - dry pipe system in the sprinkler system employing automatic sprinklers attached to a piping system containing air or nitrogen under pressure, the release of which (as from opening a sprinkler) permits the water pressure to open a valve known as a dry pipe valve. The water flows into the piping system and out of the opened sprinklers.



### 3.3.3 Pressure Tank

**3.3.3.1** Fresh water pressure tank shall be fitted with:

- .1 fresh water supply pipeline;
- .2 automatic pressure maintaining device;
- .3 water level indicating device and alarms warning of the water level and pressure drop in the tank below the minimum values;
- .4 safety valve;
- .5 pressure gauge, connected through a stop valve or cock.

**3.3.3.2** The tank capacity shall be equal to at least twice the above required quantity of fresh water in the pressure tank.

The quantity of fresh water in the pressure tank shall be equal to the quantity of sea water delivered by the sea water pump in one minute, calculated for the area of at least 280 m<sup>2</sup> at the application rate specified in 3.3.7.1.

**3.3.3.3** Provision shall be made for maintaining such air pressure in the tank that after the consumption of the whole quantity of fresh water it will be not lower than the working pressure of the sprinklers plus hydrostatic pressure from the tank bottom to the highest sprinkler.

**3.3.3.4** Arrangements for replenishing compressed air and fresh water in the pressure tank, as well as non-return valves precluding the ingress of sea water into the tank shall be provided.

**3.3.3.5** The pressure tank shall comply with the requirements for pressure vessels, set out in Chapter 12, *Part VII – Machinery, Boilers and Pressure Vessels*.

### 3.3.4 Sea Water Pump

**3.3.4.1** An independent power sea water pump shall be provided for the purpose of maintaining continuous discharge of water from the sprinklers. The pump shall be brought into action automatically by the pressure drop in the system before the standing fresh water charge in the pressure tank is completely exhausted.

**3.3.4.2** The pump and the piping system shall be capable of maintaining the necessary pressure at the level of the highest sprinkler to ensure a continuous output of water sufficient for the simultaneous coverage of a minimum area of 280 m<sup>2</sup> at the application rate specified in 3.3.7.1.

Hydraulic calculations shall be made to confirm that the water flow and pressure will be sufficient to cover the most unfavourably located section (the greatest flow resistance).

**3.3.4.3** The pump shall have fitted on the delivery side a test valve with a short open-ended discharge pipe. The effective cross-sectional area of the valve and pipe

shall be adequate to permit the release of the required pump output while maintaining the pressure in the system specified in 3.3.3.3.

**3.3.4.4** Means shall be provided for testing the automatic operation of the pump on reduction of pressure in the system.

**3.3.4.5** The sea water pump and the pressure tank shall be situated outside protected spaces, in a position reasonably remote from machinery spaces of category A.

### **3.3.5 Piping Arrangements**

**3.3.5.1** Sprinklers shall be grouped into separate sections, each of which shall contain not more than 200 sprinklers.

**3.3.5.2** Each section of sprinklers shall be capable of being isolated by one stop valve only, fitted on the supply pipe. The stop valve in each section (section valve) shall be readily accessible in a location outside of the associated section or in cabinets within stairway enclosures. A locking arrangement shall be provided to protect the section valves against access thereto by any unauthorized person.

The location of the valves shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.3.5.3** A test valve shall be provided for testing the automatic alarm for each section of sprinklers by a discharge of water equivalent to the operation of one sprinkler. The test valve for each section shall be situated near the stop valve of that section.

**3.3.5.4** Automatic sprinkler system shall have a connection from the ship's fire main by way of a non-return valve fitted with interlocking arrangement.

**3.3.5.5** A gauge indicating the pressure in the system shall be provided at each section valve and at the control station.

**3.3.5.6** The sea inlet valve shall be in the space containing the pump and shall be so arranged that when the ship is afloat it will not be necessary to shut off the supply of sea water to the pump for any purpose other than the inspection or repair of the pump.

**3.3.5.7** The suction pipes of sea water pump supplying the sprinkler system shall be fitted with filters to prevent the sprinklers against getting clogged.

**3.3.5.8** Provision shall be made in each section for blowing the pipes with compressed air and flushing them with fresh water.

### **3.3.6 Control Panels and Alarm System**

**3.3.6.1** Each section of sprinklers shall be provided with water flow sensor for giving a visual and audible alarm signal at one or more control panels, whenever

any sprinkler comes into operation. The alarm system shall be such as to indicate any fault occurring in the sprinkler system.

**3.3.6.2** Control panels shall show in which section, served by the system, fire has occurred and shall be centralized on the navigation bridge or a continuously manned central control station. In addition, visible and audible alarms from the control panel shall also be placed in a position other than on the afore-mentioned spaces to ensure that the indication of fire is immediately received by the crew.

**3.3.6.3** Switches shall be provided at one of the control panels, which enable the alarm and the indicators for each section of sprinklers to be tested.

**3.3.6.4** A scheme or plan shall be located at each control panel showing the space protected by automatic sprinkler system and the location of the fire zone in respect of each section.

**3.3.6.5** Suitable instructions for testing and maintenance of automatic sprinkler system shall be available on board the ship.

### **3.3.7 Sprinklers**

**3.3.7.1** Sprinklers shall be placed in an overhead position and spaced in a suitable pattern to maintain an average application rate of not less than 5 l/m<sup>2</sup> /min over the nominal area covered by the sprinklers. The nominal area is defined as being the gross horizontal projection of the area to be covered.

The use of sprinklers providing a lower average application rate may be permitted subject to submission of test results confirming that such sprinklers are not less effective.

Sprinklers shall be placed as clear as possible of beams or other objects likely to obstruct the projections of water and in such positions that combustible materials in the space will be well sprayed.

**3.3.7.2** In accommodation and service spaces, the sprinklers shall come into operation within the temperature range from 68 °C ÷ 79 °C, except that in locations such as drying rooms and galleys, where high ambient temperatures might be expected, the operating temperature may be increased by not more than 30 °C above the normal deckhead temperature.

**3.3.7.3** The sprinklers shall be resistant to corrosion by marine atmosphere. Sprinklers are subject to type tests in accordance with ISO 6182-1 or PN-EN 12259-1 standards, or in accordance with the guidelines specified in Annex 1 to Res. A.800(19), as amended by Res. MSC.265 (84).

**3.3.7.4** The total number of spare sprinklers for all types of sprinklers installed on board, related to the total number of sprinklers, shall be as follows:

Total number of sprinklers	Required number of spare sprinklers
< 300	6
300 ÷ 1000	12
> 1000	24

The ship shall be provided with at least 6 spare sprinklers for each section.

For each type of sprinkler, the number of spare sprinklers need not exceed the total number of installed sprinklers.

### 3.3.8 Equivalent High-Pressure Sprinkler System (Water Mist System)

**3.3.8.1** Guidelines for the design, assembly and type approval tests of equivalent high-pressure sprinkler system are specified in *Publication No. 89/P*.

**3.3.8.2** The system shall be designed, assembled and type tested in accordance with Res. A.800(19), as amended by Res. MSC.265(84).

**3.3.8.3** Type approval tests of equivalent high-pressure sprinkler systems performed in accordance with the guidelines, specified in Res. A.800(19), remain valid until 1 July 2015.

**3.3.8.4** Existing equivalent high-pressure sprinkler systems, approved and installed in accordance with the guidelines specified in Res. A.800(19) are to be permitted to remain in service as long as they are serviceable based on the survey results.

## 3.4 Water-Spraying Fire-Extinguishing Systems and Equivalent Fire-Extinguishing Systems

### 3.4.1 General Requirements

**3.4.1.1** The water-spraying fire-extinguishing system shall be fitted with the supply water pump, distribution pipelines which may be divided into sections with section valves and spraying nozzles.

**3.4.1.2** The capacity and the pressure head of the supply water pump shall be determined on the basis of the required water discharge rate, taking into account the characteristics and number of spraying nozzles installed in the largest protected space. Where the system capacity is less than 50% of the fire pumps capacity, specified in 3.2.1.5, a separate supply water pump need not be installed and the system may be supplied with water from the water fire main system. Otherwise, an independent supply water pump shall be provided, with the capacity sufficient to cover the demand of the largest protected space.

**3.4.1.3** Unless the requirements for protected spaces provide otherwise, the water discharge rate shall be taken as follows:

- 5 l/min per floor square metre – for cargo spaces and machinery spaces;
- 24 l/min per shelf square metre – for shelves in explosives store-rooms.

**3.4.1.4** The water pressure shall ensure an effective distribution of dispersed water in the protected space.

**3.4.1.5** The spraying nozzles shall be so arranged as to provide uniform distribution of dispersed water in the protected space.

**3.4.1.6** The system shall be fitted with filters preventing the nozzles from becoming clogged by impurities in sea water or pipe corrosion chips.

**3.4.1.7** Pipelines shall be capable of being drained.

**3.4.1.8** In each of the protected spaces, an adequate draining system shall be provided to enable suitable overboard discharge of water by means of gravitational force or bilge pump.

**3.4.1.9** Spaces/ group of spaces protected by water-spraying fire-extinguishing system shall be indicated by a plate with the symbol used on *Fire Control Plan*.

#### **3.4.2 Water-Spraying Fire-Extinguishing System in Ro-Ro Spaces, Special Category Spaces and Vehicle Spaces**

**3.4.2.1** The nozzles shall have such a bore that would prevent them from becoming clogged by impurities in sea water or pipe corrosion chips.

**3.4.2.2** The water discharge rate shall be at least 3.5 l/min per floor square metre – for spaces with a deck height not exceeding 2.5 m and 5 l/min per floor square metre – for spaces with a deck height of 2.5 m or more.

**3.4.2.3** Water pressure shall be sufficient to ensure uniform distribution of water.

**3.4.2.4** The system shall be sufficient to ensure uniform coverage of the full breadth of the vehicle deck and may be divided into pipe sections, provided that the length of the section is not less than 20 m, except that on ships with vehicle spaces separated by horizontal A Class divisions, enclosing stairways, etc. the section width may be appropriately reduced.

**3.4.2.5** The section valves manifold shall be placed in an easily accessible space located outside the space to be protected so as not to be cut off by a fire in the protected space. Direct access to section valves manifold from the protected vehicle space and from outside the space shall be ensured. The space containing the section valves manifold shall be well ventilated.

The location of section valves manifold shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.4.2.6** The system shall be supplied from an independent supply pump and shall be additionally connected to the water fire main, through a non-return valve fitted with a locking arrangement.

**3.4.2.7** The capacity of the pump shall be such as to be capable of providing simultaneously a sufficient supply of water at the required pressure to all nozzles in the vehicle deck or on at least two sections thereof.

**3.4.2.8** The supply water pump shall be capable of being brought into operation by remote control (which may be manually actuated) from the position close to section valves manifold.

**3.4.2.9** The water-spraying fire-extinguishing system shall be fitted with:

- .1** a pressure gauge installed on section valves manifold;
- .2** information plates located on each manifold valve, showing space/section of the piping that the valve serves;
- .3** system operation and maintenance manual located in the space housing section valves manifold. The manual shall contain a plan of the system, with division into sections and the arrangement of all sections of the system;
- .4** sufficient number of drain valves.

**3.4.2.10** The supply pump shall be situated outside the protected space. In the case of electrically driven pump, power supply cables shall not be led through protected spaces. If such arrangement is not practicable, fire-resistant cables complying with the requirements specified in 16.1.2, *Part VIII – Electrical Installations and Control Systems*, suitably protected against mechanical damage, may be permitted.

**3.4.2.11** The system shall be type approved in accordance with guidelines specified in Res. A.123(V).

### **3.4.3 Equivalent High-Pressure Water-Based Spraying Fire-Extinguishing System in Ro-Ro Spaces and Special Category Spaces**

Guidelines for the design, assembly and type tests of the system are given in *Publication No. 89/P*.

### **3.4.4 Water-Spraying Fire-Extinguishing System and Equivalent High- Pressure Water-Based Fire-Extinguishing System in Machinery Spaces and Cargo Pump-Rooms**

Guidelines for the design, assembly and type tests of the system are given in *Publication No. 89/P*.

### **3.4.5 Water-Spraying Fire-Extinguishing System and Equivalent High-Pressure Water-Based Fire-Extinguishing System for Cabin Balconies**

Guidelines for the design, assembly and type tests of the system are given in *Publication No. 89/P*.

### **3.4.6 Fixed Local Water-Based Fire-Extinguishing System for Machinery Spaces of Category A**

**3.4.6.1** In machinery spaces of category A, the system shall be capable, without the necessity of the engines shut-down, personnel evacuation or sealing the space, of protecting the areas <sup>1)</sup> containing the following equipment:

- .1** internal combustion engines parts, which constitute fire hazard<sup>2)</sup>;
- .2** boiler fronts;
- .3** incinerators parts, which constitute fire hazard;
- .4** heated oil separators;
- .5** oil-fired equipment, such as inert gas generators, thermal oil heaters, etc.

**3.4.6.2** The system shall consist of the supply water pump, distribution pipes, spraying nozzles, starting arrangement and signalling devices.

Distribution pipes shall be divided into sections protecting the above-mentioned areas.

Each section of the pipes shall be divided by a section valve – electromechanical/pneumatic, remotely controlled from the control panel and from the position of particular section operation. Provision shall be made for manual operation of the electromechanical/pneumatic valve in the event of loss of power.

**3.4.6.3** The supply water pump and section valves shall be located outside the protected areas.

**3.4.6.4** The capacity of the supply water pump shall be based on the protected area demanding the largest volume of water.

**3.4.6.5** The system shall be started manually. The system control panel with start buttons for each section shall be located in the engine control room. In addition, start buttons for particular section of the system shall be located close to each protected area.

The location of control panel and start buttons for each section of the system shall be indicated by a plate with the symbol used on *Fire Control Plan*.

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<sup>1)</sup> Protected area is an area within a protected space which is required to be protected by the system. For more precise definition – see MSC/Circ.1120, interpretations regarding SOLAS II-2/10.5.6.3.1, .2 and 3 regulations.

<sup>2)</sup> In multi-engine installations, at least two pipe sections shall be arranged.

**3.4.6.6** In ships with periodically unattended machinery spaces, the system shall have the automatic release capability – see 6.16.3.2.

Machinery space fitted with local water-spraying fire-extinguishing system operated automatically shall be indicated by a warning plate placed on access door, bearing the inscription: CAUTION. THE POSSIBILITY OF RELEASE OF THE WATER-BASED SYSTEM.

**3.4.6.7** Activation of the system shall give visual and audible alarms, as well as indication of the activated zone. Visual and audible alarms shall be provided in each protected space, in the engine control room and on the bridge. Audible alarms may use a single tone.

**3.4.6.8** The operation of the fire-extinguishing system and supply of water by each of the section shall not result in the loss of electric power or reduction of the manoeuvrability of the ship.

**3.4.6.9** The system shall be capable of fire suppression with mechanical ventilation running and supplying air to the protected space or a method of automatically shutting air supply fans upon activation of the system shall be provided.

**3.4.6.10** The system shall be available for immediate use and capable of continuously supplying water extinguishing medium for at least 20 minutes in order to suppress or extinguish the fire or to prepare for the operation of the main fire-extinguishing system.

**3.4.6.11** The supply water pump, control of the system and signalling devices shall be supplied from the main and the emergency source of electric power. Possibility of automatic switching over of power sources shall be provided.

**3.4.6.12** Guidelines for the design, assembly and type tests of the system are given in *Publication No. 89/P*.

### **3.4.7 Local Water-Spraying Fire-Extinguishing System for Exhaust Gas-Fired Thermal Heaters**

**3.4.7.1** The flow rate of the water-spraying system shall be at least 5 l/min per square metre of the heated surfaces.

**3.4.7.2** The system shall be available for immediate use and capable of continuously supplying water at full capacity for at least 20 min. The use of fresh water is recommended.

**3.4.7.3** Water-spraying nozzles shall ensure uniform distribution of water on heated heater surfaces. The nozzles shall be arranged so that the machinery space fittings do not obstruct the water jets.



**3.4.7.4** To protect against uncontrolled water leaks on heated exhaust gas-fired thermal oil heater surfaces, the supply line shall be fitted with two shut-off valves and a drain valve between them.

**3.4.7.5** Provision shall be made for manual starting of the system. Control valves and pump starters shall be installed in one easily accessible place, safely distanced from the exhaust gas-fired thermal oil heater.

The location of the system operation shall be indicated by a plate with the symbol used on *Fire Control Plan*.

Operation instructions for the system shall be also displayed at the starting arrangement.

**3.4.7.6** The exhaust gas line/duct located below the exhaust gas-fired thermal oil heater shall be protected by a water trap for collecting and draining water to prevent water flooding the engine. Water shall be drained to the bilge or a suitable waste.

**3.4.7.7** Activation of the system shall set off the alarm in the machinery space and in a continuously manned control station.

### **3.4.8 Equivalent Water-Spraying Fire-Extinguishing System for Open-Top Container Ships**

**3.4.8.1** The fire-extinguishing system shall be capable of suppressing fire in the bay of origin and to cool adjacent areas to prevent structural damage.

**3.4.8.2** The system shall be capable of spraying water into the cargo hold from deck level downward. The system shall be designed and arranged to take account of the specific hold and container configuration.

**3.4.8.3** The system shall be subdivided into sections, with each section to consist of a ring-line at deck level in an open cargo hold around a container bay.

The location of the section valves manifold shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.4.8.4** The system shall be capable of spraying the outer vertical boundaries of each container bay in an open cargo hold and of cooling the adjacent structure. The application density shall be not less than 1.1 l/min/per square metre of the hold.

**3.4.8.5** The system shall be supplied by at least one dedicated pump with a capacity to serve all container bays in any one open-top container simultaneously. The pump(s) shall be installed outside the open-top area.

**3.4.8.6** The availability of water to the water spray system shall be at least 50% of the total capacity, with adequate spray patterns in the open-top container hold, and with any one dedicated pump inoperable. For the case of a single dedicated pump, this may

be accomplished by an interconnection to an alternative source of water. The system shall be supplemented by fire hose supply from the water fire main on the open deck.

### **3.4.9 Water Screen System**

**3.4.9.1** The water screen system shall be provided for use in the following cases:

- .1** for creating “water wall” in ships with industrial spaces, where there is no possibility of installing A-60 Class divisions;
- .2** in ships adapted for operation in oil spillage area – for drenching the external bulkheads of superstructures.

**3.4.9.2** The water discharge rate of the water screen system shall be taken as follows:

- 70 l/min per linear metre of the bulkhead length as a full substitute of A-60 Class division;
- 30 l/min per linear metre of the bulkhead length for one side drenching of A-0 Class steel division.

**3.4.9.3** The water screen system may be supplied from the water fire main system; for small water screens, the system may be also supplied from sea water or fresh water pressure tank system.

**3.4.9.4** Water screen means of control shall be located in easily accessible and safe positions. The location of remote means of control shall be indicated by a plate with the symbol used on *Fire Control Plan*.

## **3.5 Fixed Foam Fire-Extinguishing Systems**

### **3.5.1 Application and General Requirements**

**3.5.1.1** Fixed foam fire-extinguishing systems are intended for the protection of machinery spaces, cargo spaces (conventional cargo holds), cargo pump-rooms, vehicle spaces, ro-ro and special category spaces. Fixed foam fire-extinguishing systems cannot be used for the protection of cargo pump-rooms in chemical tankers carrying alcohol-based liquid cargoes, unless the systems have been additionally tested with alcohol-based fuel and alcohol resistant foam.

**3.5.1.2** The foam concentrates used in the foam fire-extinguishing systems are subject to type tests in accordance with the guidelines specified in circulars: MSC.1/Circ.1312/Corr.1 – for low-expansion foam, MSC/Circ.798 – for medium-expansion foam and MSC/Circ.670 – for high-expansion foam.

**3.5.1.3** Different foam concentrate types shall not be mixed in a foam system. Foam concentrates of the same type, but produced by different manufacturers, shall also not be mixed unless considered compatible.

**3.5.1.4** A space/spaces protected by the foam fire-extinguishing system shall be indicated by an appropriate plate, placed on the space/spaces access door, with the symbol used on *Fire control plan*.

### 3.5.2 Definitions

For the purpose of the present sub-chapter, the following definitions have been adopted:

- .1** Foam generators – 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 a set of nozzles and a casing. The casing shall be 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 the screen. An electric, hydraulic or pneumatically driven fan is provided to aerate the solution.
- .2** High-expansion foam fire-extinguishing system – fixed total flooding extinguishing systems that use inside air or outside air for aeration of the foam solution. A high-expansion foam system consists of foam generators and the dedicated foam concentrate approved during the fire testing.
- .3** Inside air foam system – a fixed high-expansion foam fire-extinguishing system with foam generators located inside the protected space and drawing air from that space.
- .4** Outside air foam system – a fixed high-expansion foam fire-extinguishing system with foam generators installed outside the protected space that are directly supplied with fresh air.
- .5** Foam delivery ducts – supply ducts for introducing high-expansion foam into the protected space from foam generators located outside the protected space.
- .6** Expansion ratio – the ratio of the volume of foam to the volume of solution from which the foam is produced.
- .7** Nominal application rate – the nominal flow rate per area expressed in  $l/min/m^2$ .
- .8** Nominal foam expansion ratio – the ratio of the volume of foam to the volume of foam solution from which it is made, under non-fire conditions and at an ambient temperature of e.g.  $\pm 20$  °C.
- .9** Nominal foam production – the volume of foam produced per time unit, i.e. nominal flow rate times foam expansion ratio, expressed in  $m^3/min$ .
- .10** Nominal flow rate – the foam solution flow expressed in  $l/min$ .
- .11** Nominal filling rate – the ratio of nominal foam production to the area, expressed in  $m/min$ .

- .12 Nominal filling time – is the ratio of the height of the protected space to the space nominal filling rate, expressed in minutes.
- .13 Foam – the extinguishing medium produced when foam solution passes through a foam generator and is mixed with air.
- .14 Low-expansion foam – foam with expansion ratio up to 20 (generally about 10).
- .15 Medium- expansion foam – foam with expansion ratio between 20 and 200 (generally about 100).
- .16 High-expansion foam – foam with expansion higher than 200 (generally about 500).
- .17 Design filling rate – at least the minimum nominal filling rate used during the approval tests.
- .18 Foam solution – a solution of foam concentrate and water.
- .19 Foam mixing rate – the percentage of foam concentrate mixed with water forming the foam solution.
- .20 Foam concentrate – a liquid which, when mixed with water in the appropriate concentration forms a foam solution.
- .21 Alcohol resistant foam concentrate – foam concentrate used for extinguishing fires of water-miscible flammable liquids (polar liquids) and fires of other liquids, extinguished by typical foams.

### **3.5.3 Fixed High-Expansion Foam Fire-Extinguishing Systems**

#### **3.5.3.1 General Requirements**

**3.5.3.1.1** Fixed high-expansion foam system shall consist of foam concentrate storage tank(s), water supply pump, foam pump and foam proportioner, water and foam concentrate, distribution pipes and foam generators. The system may be fitted with ducts supplying high-expansion foam into a protected space and ducts supplying air into foam generators.

**3.5.3.1.2** The system shall be capable of manual release and shall be designed to produce foam at the required application rate within 1 minute of release. Automatic release of the system shall not be permitted unless appropriate operational measures or interlocks are provided to prevent any local fire-extinguishing systems from interfering with the effectiveness of the system.

**3.5.3.1.3** The system shall be capable of fire extinction, shall be manufactured and type tested based on the requirements guidelines specified in MSC.1/Circ.1384.

**3.5.3.1.4** The system and its components shall 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) shall be designed to withstand 925°C.

**3.5.3.1.5** The system piping, foam concentrate storage tanks, components and pipe fittings in contact with the foam concentrate shall 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 shall be made of full galvanized steel or equivalent. Distribution pipes shall have self-draining capability.

**3.5.3.1.6** Means for testing the operation of the system and assuring the required pressure and flow shall be provided by pressure gauges at both inlets (water and foam concentrate supply) and at the outlet of the foam proportioner. A test valve shall 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 shall be provided with connections for flushing, draining and purging with air. All nozzles shall be able to be removed for inspection in order to prove clear of debris.

**3.5.3.1.7** Means shall be provided for the crew to safely check the quantity of foam concentrate and take periodic control samples for foam quality. The minimum level/required foam volume shall be marked on the tank.

The location of foam concentrate storage tank shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.5.3.1.8** Operating instructions for the system shall be displayed at each operating position.

The location of the system remote control shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.5.3.1.9** Spare parts shall be provided on board in accordance with the manufacturer's instruction.

**3.5.3.1.10** If an internal combustion engine is used as a prime mover for the sea water pump for the system, the fuel oil tank shall contain sufficient fuel to enable the pump to run on full load for at least 3 h and sufficient reserves of fuel shall 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 shall be adequate for all connected engines.

The minimum level/required fuel oil volume shall be marked on the tank.

**3.5.3.1.11** The arrangement of foam generators and foam delivery piping/ducts in the protected space shall not interfere with access to the installed machinery for routine maintenance.

The location of foam delivery ducts outlets shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.5.3.1.12** The system source of power supply, foam concentrate supply and means of controlling the system shall be readily accessible and simple to operate, and shall 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 shall have at least an IP 54 rating.

**3.5.3.1.13** The piping system shall be sized in accordance with a hydraulic calculation technique, such as e.g. the Hazen-Williams method to ensure availability of flows and pressures required for correct performance of the system.

**3.5.3.1.14** The arrangement of the protected spaces shall be such that they may be ventilated as the space is being filled with foam. Procedures shall 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<sup>3</sup> need not comply with this requirement.

**3.5.3.1.15** Onboard procedures shall be established to require personnel re-entering the protected space after the system discharge to wear breathing apparatus to protect them from oxygen deficient air and products of combustion entrained in the foam blanket.

**3.5.3.1.16** Installation plans and operating manuals shall be supplied to the ship and be readily available on board. A list or plan shall be displayed showing the spaces covered and the location of the zone in respect of each section. Instructions for testing and maintenance shall be available on board.

**3.5.3.1.17** All installation, operation and maintenance instructions/plans for the system shall 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 shall be included.

**3.5.3.1.18** The foam generator room shall be ventilated to protect against overpressure, and shall be heated to avoid the possibility of freezing.

**3.5.3.1.19** The quantity of foam concentrate available shall be 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 enough for 30 min of full operation for the largest protected space, whichever is greater.

**3.5.3.1.20** Machinery spaces, cargo pump-rooms, vehicle spaces, ro-ro spaces and special category spaces shall be provided with audible and visual alarms within the protected space warning of the release of the system. The alarms shall operate for the length of time needed to evacuate the space, but in no case less than 20 s.

### **3.5.3.2 Inside Air Foam Systems**

#### **3.5.3.2.1 Systems for the Protection of Machinery Spaces and Cargo Pump-Rooms**

**3.5.3.2.1.1** The system shall be supplied by both main and emergency sources of power. The emergency power supply shall be provided from outside the protected space.

**3.5.3.2.1.2** Sufficient foam-generating capacity shall be provided to ensure that the minimum design filling rate for the system is met and in addition shall be adequate to completely fill the largest protected space within 10 min.

**3.5.3.2.1.3** The arrangement of foam generators shall, in general, be designed based on the approval test results. A minimum of two generators shall be installed in every space containing combustion engines, boilers, purifiers, and similar equipment. Small workshops and similar spaces may be covered by only one foam generator.

**3.5.3.2.1.4** Foam generators shall be uniformly distributed under the uppermost ceiling in the protected spaces including the engine casing. The number and location of foam generators shall 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 shall be arranged with at least 1 m free space in front of the foam outlets, unless tested with less clearance. The generators shall be located behind main structures, and above and away from engines and boilers in positions where damage from an explosion is unlikely.

#### **3.5.3.2.2 Systems for the Protection of Vehicle, Ro-Ro, Special Category and Cargo Spaces**

**3.5.3.2.2.1** The system shall be supplied by the ship's main power source. An emergency power supply is not required.

**3.5.3.2.2.2** Sufficient foam-generating capacity shall be provided to ensure that the minimum design filling rate for the system is met and in addition shall be adequate to completely fill the largest protected space within 10 min, except that, for the systems intended for the protection of vehicle and ro-ro spaces and special category spaces with the deck height of 3 metres or less, the filling rate shall be not less than two-thirds of the design filling rate and in addition sufficient to fill the largest protected space within 10 min.

**3.5.3.2.2.3** The system may be divided into sections, however, the capacity and design of the system shall 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.

**3.5.3.2.2.4** The arrangement of foam generators shall, in general, be designed based on the approval test results. The number of generators may be different, but the minimum design filling rate determined during approval tests shall be provided by the system. A minimum of two generators shall be installed in every space. The foam generators shall be arranged to uniformly distribute foam in the protected spaces, and the layout shall take into consideration obstructions that can be expected when cargo is loaded on board. As a minimum, generators shall be located on every second deck, including movable decks. The horizontal spacing of the generators shall ensure rapid supply of foam to all parts of the protected space. This shall be established on the basis of full scale tests.

**3.5.3.2.2.5** The foam generators shall be arranged with at least 1 m free space in front of the foam outlets, unless tested with less clearance.

### **3.5.3.3 System Using Outside Air**

#### **3.5.3.3.1 Systems for the Protection of Machinery Spaces and Cargo Pump-Rooms**

**3.5.3.3.1.1** The system shall be supplied by both main and emergency sources of power. The emergency power supply shall be provided from outside the protected machinery space.

**3.5.3.3.1.2** Sufficient foam-generating capacity shall be provided to ensure that the minimum design filling rate for the system is met and in addition shall be adequate to completely fill the largest protected space within 10 min.

**3.5.3.3.1.3** The arrangement of foam delivery ducts shall, in general, be designed based on the approval test results. The number of ducts may be different, but the minimum design filling rate determined during approval tests shall be provided by the system. A minimum of two ducts shall be installed in every space containing combustion engines, boilers, purifiers and similar equipment. Small workshops and similar spaces may be covered by only one duct.

**3.5.3.3.1.4** Foam delivery ducts shall be uniformly distributed under the uppermost ceiling in the protected spaces including the engine casing. The number and location of ducts shall 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 shall be arranged with at least 1 m free space in front of the foam delivery ducts, unless tested with less clearance. The ducts shall be located behind main structures, and above and away from engines and boilers in positions where damage from an explosion is unlikely.

**3.5.3.3.1.5** The arrangement of the foam delivery ducts shall 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 shall be installed to allow at least 450 mm of separation between the generators and the protected space, and the separating divisions shall be of A-60 Class standard. Foam delivery ducts shall 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 shall be installed at the openings in the boundary bulkheads or decks between the foam generators and the protected space. The dampers shall 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.

**3.5.3.3.1.6** The foam generators shall be located where an adequate fresh air supply can be arranged.

### **3.5.3.3.2 Systems for the Protection of Vehicle, Ro-Ro and Special Category Spaces**

**3.5.3.3.2.1** The system shall be supplied by the ship's main power source. An emergency power supply is not required.

**3.5.3.3.2.2** Sufficient foam-generating capacity shall be provided to ensure that the minimum design filling rate for the system is met and in addition shall be adequate to completely fill the largest protected space within 10 min, except that for systems intended for the protection of vehicle, ro-ro spaces and special category spaces with the deck height of 3 m or less, the filling rate shall be not less than two-thirds of the design filling rate and in addition sufficient to fill the largest protected space within 10 min.

**3.5.3.3.2.3** The system may be divided into sections, however, the capacity and design of the system shall 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.

**3.5.3.3.2.4** The arrangement of foam delivery ducts shall, in general, be designed based on the approval test results. The number of ducts may be different, but the minimum design filling rate determined during approval tests shall be provided by the system. A minimum of two ducts shall be installed in every space. The foam generators shall be arranged to uniformly distribute foam in the protected spaces, and the layout shall take into consideration obstructions that can be expected when cargo is loaded on board. As a minimum, ducts shall be led to every second deck, including movable decks. The horizontal spacing of the ducts shall ensure rapid supply of foam to all parts of the protected space. This shall be established on the basis of full scale tests.

**3.5.3.3.2.5** The system shall be arranged with at least 1 m free space in front of the foam outlets, unless tested with less clearance.

**3.5.3.3.2.6** The arrangement of the foam delivery ducts shall 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 shall be installed to allow at least 450 mm of separation between the generators and the protected space, and the separating divisions shall be of A-60 Class standard. Foam delivery ducts shall 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 shall be installed at the openings in the boundary bulkheads or decks between the foam generators and the protected space. The dampers shall 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.

**3.5.3.3.2.7** The foam generators shall be located where an adequate fresh air supply can be arranged.

#### **3.5.3.4 Installation Tests**

**3.5.3.4.1** After installation, the pipes, valves, fittings and assembled systems shall be tested, including the operation tests of the power and control systems, water pumps, foam pumps, valves, remote and local release stations and alarms. Flow at the required pressure shall be verified for the system using orifices fitted to the test line. In addition, all distribution pipes shall be flushed with fresh water and blown through with air to ensure that the piping is free of obstructions.

**3.5.3.4.2** Operation tests of all foam proportioners or other foam mixing devices shall 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 1.1 kg/dm<sup>3</sup>, this test can be performed with water instead of foam concentrate. Other arrangements shall be tested with the actual foam concentrate.

#### **3.5.3.5 Systems Using Outside Air with Foam 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, provided that these systems have been shown to have performance and reliability equivalent to the systems defined in 3.5.3.3. For acceptance, the following minimum design features shall be considered:

- .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.

### **3.5.4 Fixed Low-Expansion Foam Fire-Extinguishing Systems**

#### **3.5.4.1 Installation Requirements**

**3.5.4.1.1** The system shall consist of foam storage tank, water supply pump, foam pump and foam proportioner, water and foam distributing pipes and discharge outlets.

**3.5.4.1.2** The system shall be capable of discharging through fixed discharge outlets, in no more than 5 min, a quantity of foam sufficient to produce an effective foam blanket over the largest single area over which oil fuel is liable to spread.

**3.5.4.1.3** Means shall 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 shall be proven acceptable through calculation or by testing.

**3.5.4.1.4** The means of control of any such systems shall be readily accessible and simple to operate and shall be grouped together in as few locations as possible at positions not likely to be cut off by a fire in the protected space.

The location of the system remote control shall be indicated by a plate with the symbol used on *Fire Control Plan*.

### **3.6 Fixed Gas Fire-Extinguishing Systems**

#### **3.6.1 General Requirements**

**3.6.1.1** Fixed gas fire-extinguishing systems using halon 1211, 1301 and 2402 and perfluorocarbons shall be prohibited.

**3.6.1.2** Where the quantity of the fire-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, provided the spaces are separate.

Adjacent spaces, not separated by at least A-0 Class divisions, provided with independent ventilation, shall be regarded as one space.

If there is a connection through ventilation ducts between two or more cargo spaces protected by a fixed gas fire-extinguishing system, such spaces shall be considered as one protected space.

**3.6.1.3** Fixed gas fire-extinguishing system shall consist of container(s) for the storage of the fire-extinguishing medium, connected to a manifold, pipes fitted with control valves, normally closed, conveying the medium into the protected spaces and warning signalization. The control valves shall be so marked as to indicate clearly the spaces to which the pipes are led.

**3.6.1.4** Where air receivers (e.g. diesel engine starting air receivers) are installed in a protected space, the volume of the receivers converted to free air volume shall be added to the gross volume of the space when calculating the necessary quantity of the fire-extinguishing medium. Alternatively, a discharge pipe may be fitted and led directly to the open air.

**3.6.1.5** Means shall be provided for the crew or shore personnel to safely check the quantity of the fire-extinguishing medium in the containers, without the necessity to move the containers completely from their fixing position. For carbon dioxide systems, hanging bars for a weighing device above each bottle row or other means shall be provided. For other types of extinguishing media, suitable surface indicators may be used.

In space, in which containers with fire-extinguishing medium are located, adequate clearance, above the containers, shall be provided to facilitate the containers exchange.

**3.6.1.6** Pressure container(s) for the storage of fire-extinguishing medium and associated pressure components shall be designed to the relevant national standards, having regard to their locations and maximum ambient temperatures expected in service. The maximum ambient temperature 55<sup>0</sup> C, expected in service, is assumed.

**3.6.1.7** The piping for the distribution of fire-extinguishing medium shall be so arranged and discharge nozzles so positioned as to ensure a uniform distribution of the medium in the protected space.

Classification documentation shall contain the system flow hydraulic calculations.

**3.6.1.8** Unless expressly provided otherwise, pressure containers for the storage of fire-extinguishing medium shall be located outside protected spaces, in fire-extinguishing stations complying with the requirements specified in 3.6.2.

**3.6.1.9** Spare parts for fire-extinguishing systems shall be stored on board in accordance with the system manufacturer's requirements. The recommended number of spare parts and tools for fire-extinguishing systems is given in 5.2.2.

**3.6.1.10** All openings in boundaries and decks of spaces protected by a fixed gas fire-extinguishing system, which may admit air to or allow gas to escape from the space shall be capable of being closed from outside of the protected space.

**3.6.1.11** In piping sections, where valve arrangements introduce sections of closed piping, such sections shall be fitted with a pressure relief valve, the outlet of the valve being led to the atmosphere.

**3.6.1.12** All discharge piping, fittings and nozzles in the protected spaces shall be constructed of materials having a melting temperature which exceeds 925 °C.

Where fittings or nozzles are constructed of components/materials for which the melting temperature is not specified, such components/materials shall be furnished with a document confirming their melting temperature.

The piping and the associated equipment shall be adequately supported.

**3.6.1.13** Pipes distributing fire-extinguishing medium into protected spaces shall be fitted with a stub-pipe for connecting to compressed air used for the piping passage test.

**3.6.1.14** Cargo spaces protected by gas fire-extinguishing system shall not be permitted to be periodically used for the carriage of passengers.

**3.6.1.15** The pipes for conveying fire-extinguishing medium may pass through accommodation spaces, provided that they are of substantial thickness over their whole length within these spaces, are joined only by welding without drains or other openings and that their tightness is verified with a pressure test, after their installation, at a pressure head not less than 5 MPa. The pipes for conveying fire-extinguishing medium shall not pass through refrigerated spaces.

**3.6.1.16** At each entrance/manhole to the space protected by gas fire-extinguishing system, a warning plate, bearing the following inscription, shall be placed:

**SPACE PROTECTED BY ..... GAS-FIRE-EXTINGUISHING SYSTEM  
LEAVE THIS AREA IMMEDIATELY WHEN THE ..... WARNING  
SIGNAL IS SOUNDED. DANGER OF SUFFOCATION**

In place of dots, the name of the fire-extinguishing medium (e.g. CO<sub>2</sub>) and the description of the warning signal shall be given.

The notice shall be made in red letters on a white background.

Spaces protected by gas fire-extinguishing system shall be additionally indicated by a plate, placed on access door, with the symbol used on *Fire Control Plan*.

**3.6.1.17** In the case of systems for which high concentration of extinguishing medium (CO<sub>2</sub>, inert gas) is required, to prevent an excessive pressure in a space protected by a fire-extinguishing system due to the discharge of the extinguishing medium, means shall be provided for the release of air through an opening in the upper part of the space, e.g. ventilation dampers, machinery casing skylights. The system operating instructions shall clearly specify which opening should be closed last after admission of the extinguishing medium into the space.

**3.6.1.18** The ship shall be provided with operating instructions for each system, prepared by the manufacturer, containing a checklist for periodical inspections and maintenance, to be performed by the crew. The instructions shall also contain crew safety pre-start procedures. Operating instructions shall be displayed at the starting arrangements.

### **3.6.2 Fire-Extinguishing Stations**

**3.6.2.1** Fire-extinguishing stations are spaces intended for the storage of fire-extinguishing medium and fire-extinguishing system equipment.

**3.6.2.2** Fire-extinguishing station shall be located outside protected spaces, in a safe place and easily accessible from crew accommodation spaces.

**3.6.2.3** The boundaries and decks separating fire-extinguishing station from adjacent spaces shall have the same fire integrity as is required for control station.

**3.6.2.4** Fire-extinguishing stations shall not be located forward of the collision bulkhead and shall not be used for any other purposes than the storage of fire-extinguishing medium and fire-extinguishing system operation.

**3.6.2.5** Fire-extinguishing station shall additionally comply with the following requirements:

- .1** it shall be located on the open deck and have direct access from the open deck or shall be located below the deck with access from the open deck – by means of stairways or permanently fixed steel ladder. Entrance to the station shall be independent of the protected space;
- .2** it shall be separated from adjacent spaces by gastight bulkheads and decks. All means of closing any openings therein shall be gastight;
- .3** access doors shall open outwards;
- .4** it shall be provided with effective natural ventilation, with ventilation grates located in the lower and upper parts of the space. Where the station is located below the open deck or where the access from the open deck is not provided it shall be fitted with mechanical ventilation system designed to take exhaust air from the bottom of the space and to provide at least 6 air changes per hour. Ventilation ducts serving other spaces shall not be connected to the fire-extinguishing station ventilation system.  
The ventilation fan shall operate automatically by the opening of the station access door. The operation of the fan shall be indicated by a visual signal.  
The exhaust duct outlet shall be led to the open deck and shall be so located as to ensure that CO<sub>2</sub> will not be drawn into other ventilation outlets.
- .5** it shall be provided with thermal insulation so that the temperature inside the station does not exceed +45 °C. The station shall be fitted with heating if it is essential for normal operation of the station that the temperature shall be maintained above the freezing point;

- .6 means shall be provided for measuring temperature inside the station;
- .7 it shall be locked; the key for the lock shall be kept in a break-glass-type closure, located near the entrance to the station<sup>1)</sup>;
- .8 it shall be provided with means of communication with central control station, navigation bridge and machinery space;
- .9 it shall be provided with fire-extinguishing system operating instructions, including pre-start procedures;
- .10 the lighting of the station shall be supplied from the main and emergency source of electric power;
- .11 the station shall be indicated by a plate, placed on access door, with the symbol used on *Fire Control Plan*.

**3.6.2.6** Fire-extinguishing media protecting the cargo spaces may be stored in a room located forward of the cargo spaces, but aft of the collision bulkhead, provided that both the local manual release mechanism and remote control(s) for the release of the media are fitted and the latter is of robust construction or so protected as to remain operable in case of fire in the protected space.

The remote controls shall be placed in the accommodation area in order to facilitate their ready accessibility by the crew. The capability to release different quantities of fire-extinguishing media into each of the protected spaces shall be included in the remote release arrangement.

### **3.6.3 Operation of the System, Warning Signalization and Time Delay**

**3.6.3.1** Fixed gas fire-extinguishing system shall be operated manually by means of distribution valves fitted on the pipes conveying fire-extinguishing media into the space. Automatic release of fire-extinguishing medium shall not be permitted, except for local fire-extinguishing systems provided as additional to and independent of fire-extinguishing systems required for machinery spaces, fitted above the equipment which constitute high fire risk or in high fire risk areas in machinery spaces.

**3.6.3.2** In the case of systems intended for the protection of two or more spaces, the distribution valves on the pipes conveying fire-extinguishing medium into the protected spaces shall be so marked as to indicate clearly the spaces to which the pipes are led.

**3.6.3.3** Suitable provision shall be made to prevent inadvertent release of fire-extinguishing medium into the protected space.

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<sup>1)</sup> Having regard to the requirements concerning the threat of terrorist attacks on ships, other closing arrangements of the station precluding access to the station by unauthorized persons while providing easy access thereto for the crew, without the search for a key, are permitted.

**3.6.3.4** Fire-extinguishing system for the protection of machinery spaces, cargo pump-rooms, ro-ro spaces, refrigerated spaces on container ships shall be provided with manual remote controls (control cabinets/ panels) located outside the space, and if practicable, at the exit from the space. A separate control cabinet/panel shall be provided for each protected space, fitted with a plate bearing the name of the space.

Control cabinet/panel shall be locked; the key for the lock shall be kept in a break-glass-type closure, located near the entrance to the control cabinet/panel<sup>1)</sup>.

Each remote control cabinet/panel shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.6.3.5** Control cabinets/panels shall be readily accessible, simple to operate and shall be grouped together in as few locations as possible above the bulkhead deck at position(s) not likely to be cut off by a fire in a protected space. At each location there shall be provided fire-extinguishing system operating instructions, including crew safety pre-start procedures.

**3.6.3.6** Where the protected space is provided with mechanical ventilation, the opening of the control cabinet/panel and opening the valve on the pipe conveying fire-extinguishing medium to the space shall automatically shut off ventilating fans serving this space.

It shall not be possible to switch on ventilating fans until the control cabinet/panel is brought to its initial condition.

Electrical system of shutting off ventilating fans shall be supplied from uninterrupted power system (UPS).

**3.6.3.7** Spaces protected by a gas fire-extinguishing system, such as machinery spaces, cargo pump-rooms, ro-ro spaces, refrigerated spaces on container ships, as well as other spaces in which the crew is normally employed or to which they have access through doors or manholes shall be fitted with automatic visual and audible warning signalization – alerting of the release of fire-extinguishing medium, complying with the requirements specified in 4.3.

Conventional cargo spaces and small spaces (such as compressor rooms, paint lockers, etc.), fitted with local fire-extinguishing system only, need not be provided with such warning signalization.

**3.6.3.8** The warning signalization shall be automatically activated, e.g. by a micro-switch that activates the signalization upon opening the control cabinet/panel. The signalization shall operate for the length of time needed to evacuate the space, but in no case less than 20 s before the medium is released.

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<sup>1)</sup> Having regard to the requirements concerning the threat of terrorist attacks on ships, other closing arrangements of the control cabinet/panel precluding access to these places by unauthorized persons while providing easy access thereto for the crew, without the search for a key, are permitted.



**3.6.3.9** The release of fire-extinguishing medium into a space shall be delayed by an automatic time-delay device for the length of time needed to evacuate the space, not shorter than 20 s and not longer than 45 s.

If electrical time-delay device is used, it shall be supplied from uninterrupted power system (UPS).

**3.6.3.10** Automatic time delay mechanism is not required for systems using hydrocarbon halogen derivatives extinguishing media whose extinguishing concentration is not higher than the lowest observed adverse effect level (LOAEL), as well as for systems using inert gases whose extinguishing concentration is not higher than 52%, calculated for the largest space.

### 3.6.4 Carbon Dioxide Systems

#### 3.6.4.1 General Requirements

**3.6.4.1.1** Carbon dioxide fire-extinguishing system is intended for the protection of machinery spaces and cargo spaces. The quantity of carbon dioxide, ( $G$ ), for particular spaces, shall be calculated from the formula:

$$G = 1.79 \cdot V \cdot \varphi \text{ [kg]}$$

where:

$V$  – design volume of the largest space to be protected – the gross volume of the space – see the definitions given in 1.2.41, [m<sup>3</sup>];

$\varphi$  – filling factor:

$\varphi = 0.3$  – for cargo spaces (conventional cargo spaces) and other spaces, except machinery spaces;

$\varphi = 0.35$  – for machinery spaces, the volume of which includes the volume of casings;

$\varphi = 0.4$  – for machinery spaces, the volume of which does not include the volume of casings above the level, at which the horizontal section area of the casing does not exceed 40% of the machinery space area, taken midway between the tank top and the lowest part of the casing;

$\varphi = 0.45$  – for vehicle and ro-ro spaces capable of being sealed.

**Note:** For machinery spaces, such value of  $\varphi$  shall be taken at which  $G$  is the greatest.

For cargo ships of less than 2000 gross tonnage, the 0.35 and 0.4  $\varphi$  values may be reduced to 0.3 and 0.35, respectively if two or more machinery spaces, which are not entirely separate, are considered as forming one space.

**3.6.4.1.2** The total quantity of CO<sub>2</sub> on board shall be sufficient for the protection of the largest space.

**3.6.4.1.3** For machinery spaces, the piping system shall be such that 85% of the required quantity of gas can be discharged into the space within not longer than 2 min.

**3.6.4.1.4** For vehicle and ro-ro spaces capable of being sealed, the piping system shall be such that at least 2/3 of the required quantity of gas can be discharged into the space within not longer than 10 min.

**3.6.4.1.5** For container and general cargo spaces (primarily intended to carry a variety of cargoes separately secured or packed), the fixed piping system shall be such that at least two-thirds of the carbon dioxide can be discharged into the space within 10 min.

For solid bulk cargo spaces, the fixed piping system shall be such that at least two-thirds of the carbon dioxide can be discharged into the space within 20 min.

The system controls shall be arranged to allow one-third, two-thirds or the entire quantity of carbon dioxide to be discharged based on the loading condition of the hold.

**3.6.4.1.6** CO<sub>2</sub> discharge time for each protected spaces shall be checked by calculations to be enclosed with CO<sub>2</sub> fire-extinguishing system classification documentation.

### **3.6.4.2 Means of Control**

**3.6.4.2.1** Carbon dioxide fire-extinguishing system shall be operated in accordance with the requirements specified in 3.6.3 and the requirements set forth in the present sub-chapter.

**3.6.4.2.2** Remote controls of carbon dioxide fire-extinguishing system intended for the protection of machinery spaces, cargo pump-rooms, ro-ro spaces, refrigerated spaces on container ships, spaces to which the crew have access through doors or manholes and spaces in which the crew normally work and to which they have access shall comply with the following requirements:

- .1** two separate controls shall be provided for releasing carbon dioxide into a protected space and to ensure the activation of the warning signalization<sup>1)</sup>. One control shall be used for opening the valve of the piping which conveys gas into the protected space and a second control shall be used to discharge gas from its storage containers. Positive means shall be provided so that they can only be operated in that order. The positive means shall be achieved by a mechanical and/or electrical interlock that does not depend on any operational procedure to achieve the correct sequence of operation.

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<sup>1)</sup> The two separate controls for releasing carbon dioxide into the protected space can be independent of the controls activating the warning signalization, see 3.6.3.8.

Where electrical interlock is used, it shall be supplied from uninterrupted power supply (UPS);

- .2 the two controls shall be located inside a release cabinet clearly identified for the particular space. If the cabinet containing the controls is to be locked, a key to the cabinet shall be in a break-glass-type closure conspicuously located adjacent to the cabinet.

**3.6.4.2.3** Pneumatic release cabinet shall consist of the main and the spare pilot cylinders, control devices and pilot line pipes. The capacity of each pilot cylinder shall be such as to ensure the opening of remotely controlled valves, at the most unfavourable ambient temperature.

Pilot line pipelines shall be made of steel, be welded or connected by mechanical joints and shall not be led through spaces/areas close to arrangements where they may be subjected to damage.

**3.6.4.2.4** In addition to remote control, provision shall be made for manual operation of the system from fire-extinguishing station, by manual opening of each valve of the piping which conveys gas into the protected space and each cylinder valve.

### **3.6.4.3 CO<sub>2</sub> Cylinders**

**3.6.4.3.1** The total quantity of CO<sub>2</sub>, calculated for the largest protected space, shall be stored in the cylinders. The number of cylinders shall be specified with due regard to cylinder typical volume (80 l, 67 l, 45 l) and the filling ratio (i.e. the quantity of CO<sub>2</sub> per 1 l of the cylinder volume), which shall not exceed 0.67 kg/l – for the cylinder of the design pressure 12.5 MPa and 0.75 kg/l – for the cylinder of design pressure 15 MPa and over.

It is recommended that the quantity of CO<sub>2</sub> in the cylinder should be not greater than 45 kg and the filling ratio - not greater than 0.67 kg/l .

All cylinders in the fire-extinguishing station shall be of the same size.

**3.6.4.3.2** The cylinders in fire-extinguishing stations shall be placed vertically in rows on insulation pads which may be made of wood.

The cylinders shall be accessible for inspection and for checking the amount of carbon dioxide contained therein. Each cylinder shall be painted red and numbered.

**3.6.4.3.3** Cylinders shall be fitted with relief valves or bursting disks, operating or bursting at a pressure rise in the cylinders to 1.3  $p$  ( $\pm 0.1$  %), where  $p$  means the cylinder design pressure.

Where the fire-extinguishing station is located below the open deck, carbon dioxide from the relief valves or bursting disks shall be discharged to the atmosphere by a special pipe.

The relief valve vents shall be so located as to ensure that gas is not drawn back into other ventilation intakes.

**3.6.4.3.4** CO<sub>2</sub> cylinders shall comply with the requirements of ISO 9809 and ISO 3500 or the relevant national standards. Each cylinder shall be furnished with PRS certificate.

**3.6.4.3.5** Each CO<sub>2</sub> cylinder shall be connected to a manifold by a flexible hose and a non-return valve. The non-return valve shall be so located on the manifold as to allow disconnection of a single cylinder, without affecting the system operation. The flexible hose shall withstand the maximum pressure in CO<sub>2</sub> cylinder and shall be type approved in accordance with the requirements specified in sub-chapter 1.16.12, *Part VI – Machinery Installations and Refrigerating Plants*.

#### **3.6.4.4 Pipes, Fittings and CO<sub>2</sub> Discharge Nozzles**

**3.6.4.4.1** The main CO<sub>2</sub> pipeline from cylinders up to and including distribution valves – the so-called manifold shall be designed for a nominal working pressure of 10 MPa and shall be made of seamless steel pipes certified by PRS. Distribution valves shall be made from steel and shall be flange type.

The remaining CO<sub>2</sub> pipelines shall also be made from steel seamless pipes, but may be furnished with the steel mill certificate.

The pipe wall thickness shall comply with Table 1.16.3.1-1, *Part VI – Machinery Installations and Refrigerating Plants*.

**3.6.4.4.2** CO<sub>2</sub> manifold shall be fitted with a pressure gauge, a stub-pipe (with a non-return valve) for blowing the pipes with compressed air and safety valve. The safety valve opening pressure shall be 13 MPa and the flow area of the valve shall enable the discharge of excess CO<sub>2</sub> to the atmosphere without causing overpressure of the manifold.

Where the fire-extinguishing station is located below the open deck, CO<sub>2</sub> discharge from the safety valve shall be led to the atmosphere by a special pipe.

The safety valve vents shall be so located as to ensure that CO<sub>2</sub> is not drawn back into other ventilation intakes.

**3.6.4.4.3** Carbon dioxide shall be discharged into protected spaces through discharge nozzles. The number and arrangement of the nozzles in the protected space shall be such as to ensure uniform distribution of carbon dioxide in the space. Discharge nozzles shall be made of steel or steel equivalent material.

**3.6.4.4.4** In machinery spaces and boiler rooms, the nozzles shall be arranged having regard to the arrangement of the machinery and equipment which constitute fire risk. The nozzles shall be preferably located in the lower part of the space, above the machinery which pose fire risk and below floor, for the protection of the bilges.

Nozzles shall be also fitted in the engine casing if equipment of increased fire risk, e.g. oil-fired boilers, is arranged there.

Nozzles shall not be placed over escape routes or ladders provided to allow ease of evacuation of the space.

**3.6.4.4.5** In cargo spaces, CO<sub>2</sub> nozzles shall be located in upper part of the space.

If CO<sub>2</sub> system is connected with a sample extraction smoke detection system, the nozzles shall be so arranged that no part of the overhead deck area is more than 12 m horizontally away from a nozzle. The sample extraction smoke detection system shall comply with the requirements specified in sub-chapter 4.2. In cargo space where 'tween deck panels (movable stowage platforms) are provided, the nozzles shall be located in both the upper and lower upper parts of the cargo space.

**3.6.4.4.6** Water traps during CO<sub>2</sub> pipes fitting, which can allow water to accumulate, shall be avoided. Where this is not possible, a short run off piece with a drain plug shall be fitted in the lowest points.

**3.6.4.4.7** On the main pipeline conveying CO<sub>2</sub> to the spaces in which the crew is normally employed or to which they have access, an adjustable flange with position indicator shall be installed before manifold to cut the flow of CO<sub>2</sub> to the spaces during the system inspection and tests.

### **3.6.4.5 Fire-Extinguishing Stations (for the Storage of CO<sub>2</sub> Cylinders)**

**3.6.4.5.1** Fire-extinguishing stations shall comply with the requirements of 3.6.2 and additionally with the requirements, given below:

- .1** they shall be provided with thermal insulation and ventilation so constructed that the temperature inside the station does not exceed +49 °C – for cylinders with filling factor 0.67 and +40 °C – for cylinders with filling factor 0.75;
- .2** provision shall be made for monitoring the air temperature in the fire-extinguishing station from outside the station. If this is to be a thermometer, it shall be so fitted in the station as to be visible both from the inside of the station and, through a sidescuttle, from outside of the station.

**3.6.4.5.2** Fire-extinguishing station shall be provided with the system operating manual containing the system diagram, pipelines distributing CO<sub>2</sub> to particular protected machinery/cargo spaces, properly marked distribution valves and the system operation remote controls means. In addition, the manual shall contain the following information:

- .1** the required quantity of CO<sub>2</sub> [kg] for the protection of the largest space and the required total number of CO<sub>2</sub> cylinders in the station;
- .2** the number of CO<sub>2</sub> cylinders required to distribute CO<sub>2</sub> to each protected machinery space, served by separate pipe sections with distribution valves;
- .3** safety procedures for the crew<sup>1)</sup>;

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<sup>1)</sup> The procedures shall contain information stating that during periodical tests of the system, having in mind the safety of the persons who may present in the protected spaces, the manifold with the

- .4 list of openings which shall be closed in order to seal each protected before discharge of CO<sub>2</sub> to the space;
- .5 proceedings in the case of emergency operation of the system directly from the fire-extinguishing system if remote operation directly from release cabinet is not possible;
- .6 proceedings to be followed by the crew after the use of CO<sub>2</sub> system;
- .7 actions to be taken to make the system operable after fire suppression.

**3.6.4.5.3** The CO<sub>2</sub> system operating manual for the protection of cargo spaces (holds) shall additionally specify the number of cylinders required for the protection of each cargo space (hold) for the following conditions:

- .1 the cargo space (hold) is empty;
- .2 the cargo space (hold) is 50% loaded;
- .3 the cargo space (hold) is 100% loaded.

#### **3.6.4.6 Warning Signalization and Time Delay**

**3.6.4.6.1** Spaces protected by the CO<sub>2</sub> system in which personnel normally work or to which they have access shall be provided with warning signalization, see 3.6.3.7 and 3.6.3.8.

**3.6.4.6.2** The warning signalization shall be also automatically activated in the event of emergency operation of the system from fire-extinguishing station after opening the valve in the piping which conveys CO<sub>2</sub> to a protected space.

**3.6.4.6.3** The release of CO<sub>2</sub> into the space in which personnel normally work or to which they have access shall be delayed by means of automatic time-delay device, see 3.6.3.9.

#### **3.6.4.7 The System Testing**

After the system has been installed on board, accepted and pressure tested within the scope and at the pressure specified in Table 3.11, the following shall be carried out:

- .1 all CO<sub>2</sub> pipes and nozzles shall be blown through using compressed air or nitrogen;
- .2 operation test of the warning signalization shall be performed.

The guidelines for periodical inspections and tests of the CO<sub>2</sub> system are given in MSC.1/Circ.1318.

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connected CO<sub>2</sub> cylinders shall be fitted with adjustable flange (if provided) or be disconnected from the pipelines distributing CO<sub>2</sub> to the spaces.

### **3.6.5 Low Pressure Carbon Dioxide Systems**

#### **3.6.5.1 General Requirements**

**3.6.5.1.1** Low pressure carbon dioxide system with regard to: the required amount of carbon dioxide, time of discharge into the protected spaces, location of discharge nozzles in the protected spaces and CO<sub>2</sub> warning signalization – shall comply with the requirements specified in 3.6.4. Additionally, the system shall comply with the requirements of the present sub-chapter.

**3.6.5.1.2** CO<sub>2</sub> storage tanks, refrigerating units, control devices and other equipment of the system shall be located in the same space, complying with the requirements for fire-extinguishing station specified in 3.6.4.5.

#### **3.6.5.2 CO<sub>2</sub> Storage Tanks**

**3.6.5.2.1** The required amount of liquid carbon dioxide shall be stored in tank(s) under a working pressure in the range of 1.8 – 2.2 MPa. The normal liquid charge in the tanks shall be limited to provide sufficient vapour space to allow for the expansion of the liquid carbon dioxide under the maximum storage temperature that can be obtained corresponding to the setting of the pressure relief valves but it shall not exceed 95% of the volumetric capacity of the tank.

**3.6.5.2.2** Carbon dioxide storage tank shall be designed, constructed and tested in accordance with the requirements of *Part VII – Machinery, Boilers and Pressure Vessels*. The tank shall be fitted with:

- .1** a pressure gauge;
- .2** high pressure alarm – not higher than the setting of the safety relief valve;
- .3** low pressure alarm – not less than 1.8 MPa;
- .4** branch pipes with stop valves for filling the tank;
- .5** discharge pipes;
- .6** a liquid CO<sub>2</sub> level indicator;
- .7** two safety relief valves;
- .8** an alarm device signalling the minimum level (stock) of carbon dioxide.

**3.6.5.2.3** The two safety relief valves shall be so arranged that either valve can be shut off while the other is connected to the tank. The setting of the relief valves shall not be less than 1.1 times the working pressure. The capacity of each valve shall 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 shall be led to the atmosphere.

**3.6.5.2.4** The tank(s) and outgoing pipes permanently filled with carbon dioxide shall have thermal insulation preventing the operation of the safety relief valve in

24 h after de-energizing the plant, at ambient temperature of 45°C and an initial pressure equal to the starting pressure of the refrigerating unit.

The insulating materials and their liners shall have adequate mechanical properties, fire resistance and protection against penetration of water vapours – subject to PRS' approval.

### **3.6.5.3 Refrigerating Units of CO<sub>2</sub> Tank**

**3.6.5.3.1** The tank shall be serviced by two automated completely independent refrigerating units solely intended for this purpose, each comprising a compressor (with its prime mover), evaporator and condenser.

In the event of failure of either one of the refrigerating units, the other shall be actuated automatically. Provision shall be made for local manual control of the refrigerating plant.

**3.6.5.3.2** Refrigerating units shall comply with the requirements specified in Chapter 21, *Part VII – Machinery Installations and Refrigerating Plants*. The refrigerating capacity and automatic control of each unit shall 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 temperatures up to 45°C.

**3.6.5.3.3** Each electric refrigerating unit shall be supplied from the main switchboard busbars by a separate feeder.

**3.6.5.3.4** Cooling water supply to the refrigerating plant (where required) shall be provided from at least two circulating pumps, one of which 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 shall be taken from not less than two sea connections, preferably one port and one starboard.

### **3.6.5.4 Pipes, Fittings and CO<sub>2</sub> Discharge Nozzles**

**3.6.5.4.1** The pipes, valves and fittings shall be in accordance with the requirements for a design pressure not less than the design pressure of the CO<sub>2</sub> tanks.

**3.6.5.4.2** Safety relief devices shall be provided in each section of the 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.

**3.6.5.4.3** The piping system shall be so designed that the pressure at the nozzles will be not less than 1 MPa. The pipes, fittings and discharge nozzles shall comply with the requirements specified in 3.6.4.4.



**3.6.5.4.4** Pipe connections shall be provided on the open deck on the port and starboard sides for filling CO<sub>2</sub> tanks. The pipes shall be fitted with valves allowing to equalize pressure during filling the CO<sub>2</sub> tank.

### **3.6.5.5 Alarms**

Audible and visual alarms shall be given in permanently manned control station when:

- .1 the pressure in the tank reaches the low or high value specified in 3.6.5.2.1;
- .2 any one of the refrigerating units fails to operate;
- .3 the lowest permissible level of CO<sub>2</sub> in the tank is reached.

### **3.6.5.6 Release Control**

**3.6.5.6.1** The release of CO<sub>2</sub> shall be initiated manually. The means of control shall comply with the requirements specified in 3.6.4.2.

**3.6.5.6.2** If the system serves more than one space, means for control of discharge quantities of CO<sub>2</sub> shall be provided, e.g. automatic timer or accurate level indicators located at the control position.

**3.6.5.6.3** If a device is provided which automatically regulates or stops the discharge of the rated quantity of carbon dioxide into the protected spaces, it shall be also possible to regulate the discharge manually.

### **3.6.5.7 The System Testing**

After having been assembled on board, the system shall be subjected to acceptance and tests in accordance with the approved test programme. The scope of the tests shall include refrigerating unit operation tests and the requirements specified in 3.6.4.7.

## **3.6.6 Local Carbon Dioxide Fire-Extinguishing Stations in Machinery Spaces**

**3.6.6.1** In well-grounded cases, local CO<sub>2</sub> fire-extinguishing systems may be located in machinery spaces where the crew is normally employed for extinguishing fire of internal combustion engines silencers and pipes.

**3.6.6.2** The maximum number of CO<sub>2</sub> cylinders located in the machinery space shall be such that CO<sub>2</sub> concentration in the space after its emergency release does not exceed 5% of the gross volume, i.e. concentration safe for the persons in the space. A greater number of CO<sub>2</sub> cylinders is permitted, provided that carbon dioxide from CO<sub>2</sub> cylinder safety valves is discharged to the atmosphere by a special pipe fitted with an audible signalling device.

**3.6.6.3** Local CO<sub>2</sub> fire-extinguishing system shall consist of CO<sub>2</sub> cylinder, manifold and pipelines, with isolating valves, conveying carbon dioxide to particular protected spaces and connected to discharge nozzle. The manifold shall be fitted with a pressure gauge and a stub-pipe for blowing the pipes with compressed air.

**3.6.6.4** The location of the CO<sub>2</sub> cylinder and the system operation position shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.6.6.5** Operating instructions of the system shall be placed close to the system operation position.

### **3.6.7 Local Carbon Dioxide Fire-Extinguishing System for Extinction of Fire in Exhaust Duct from the Galley**

**3.6.7.1** A local carbon dioxide fire-extinguishing station for extinction of fire in exhaust duct from the galley range shall consist of CO<sub>2</sub> cylinder, supplying pipeline and discharge nozzles, fitted in the duct. The necessary quantity of carbon dioxide shall be calculated from the formula:

$$G = 1.79 \cdot V \cdot \varphi \cdot z \text{ [kg]}$$

where:

$V$  – volume of space above galley range, plus volume of ventilation duct, [m<sup>3</sup>];

$\varphi$  – duct filling factor equal to 0.4;

$z$  – coefficient of losses,

$z = 2$ .

**3.6.7.2** Carbon dioxide may be stored in one or more cylinders in a cabinet inside the galley space. The maximum CO<sub>2</sub> quantity shall be such that the CO<sub>2</sub> concentration in the space after its release does not exceed 5% of the gross volume.

**3.6.7.3** Discharge nozzles shall be situated inside the duct, between the lower and the upper fire dampers.

**3.6.7.4** The location of the CO<sub>2</sub> cylinders and the system operation position shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.6.7.5** Operating instructions of the system shall be placed in the vicinity of the system operation position informing on the necessity to shut off the exhaust fan and to close fire dampers before CO<sub>2</sub> release into the duct.

### **3.6.8 Steam Fire-Extinguishing Systems**

**3.6.8.1** The use of steam as a fire-extinguishing medium in fixed fire-extinguishing systems required by the present Part of the *Rules* is not permitted. Steam fire-extinguishing system, approved by PRS, may be used only in restricted areas as an addition to the required fixed fire-extinguishing systems.

**3.6.8.2** The boiler supplying steam shall have an evaporation of at least 1 kg of steam per hour for each 0.75 m<sup>3</sup> of the gross volume of the largest space so protected. Additionally, the system is subject to PRS' consideration with respect to its reliability and fire-extinguishing efficiency.

**3.6.8.3** The boiler shall ensure a continuous supply of steam with the required capacity under normal service conditions.

## **3.7 Equivalent Fixed Gas Fire-Extinguishing Systems**

### **3.7.1 Equivalent Fixed Gas Fire-Extinguishing Systems for Machinery Spaces and Cargo Pump-Rooms**

Guidelines for the design, assembly and type approval tests of the system are specified in *Publication No. 89/P*.

### **3.7.2 Aerosol Fire-Extinguishing System for Machinery Spaces**

Guidelines for the design, assembly and type approval tests of the system are specified in *Publication No. 89/P*.

## **3.8 Dry Powder Fire-Extinguishing System**

### **3.8.1 General Requirements**

**3.8.1.1** Nitrogen or other type of inert gas may be used as the powder carrier.

**3.8.1.2** The system shall consist of:

- .1** fire-extinguishing stations, where powder containers, gas (powder carrier) pressure vessels and distribution manifolds are stored;
- .2** fire control stations, where starting cylinders, fire hose nozzles with hoses or powder monitors are stored;
- .3** pipings and fittings for the activation of the system and for the powder supply to fire control stations.

**3.8.1.3** Remote activation of the system from any one of the fire control stations shall be ensured.

The system shall be ready to operate not later than 30 s from the opening of starting cylinder at the remotest, from the fire-extinguishing station, fire control station.

**3.8.1.4** Powder shall be furnished with quality certificate issued by an authorized body or manufacturer.

### **3.8.2 Quantity of the Powder and Gas (Powder Carrier), as well as the Number and Capacity of Fire Hose Nozzles and Monitors**

**3.8.2.1** In each container stored in the fire-extinguishing station, there shall be a design quantity of powder adequate for a continuous operation during at least 45 s of all fire hose nozzles and monitors connected to one station, at their rated capacity.

**3.8.2.2** The capacity of each fire hose nozzle shall be not less than 3.5 kg/s and the distance of powder coverage not less than 8 m. When determining the maximum distance of coverage of a fire hose nozzle, the length of the hose shall be taken into account.

The capacity of each monitor shall be not less than 10 kg/s; 10, 30 and 40 m shall be taken as the maximum distances of powder discharge for the monitors of 10, 25 and 45 kg/s capacity, respectively.

**3.8.2.3** The quantity of powder for the protection of control stations and store-rooms of readily ignitable materials shall be such as to ensure a continuous operation of the system during at least 10 s at the discharge rate of 0.1 kg/m<sup>3</sup> per one second.

**3.8.2.4** The quantity of gas (powder carrier) shall be sufficient for a single discharge of the total quantity of powder in the container.

### **3.8.3 Fire-Extinguishing Stations of Dry Powder System**

If two or more fire control stations are connected to the fire-extinguishing station, each of them shall be supplied from the powder manifold by an independent pipe fitted with a valve.

The fire-extinguishing station arrangements shall enable the operation of both the individual fire control stations and all the stations simultaneously.

Fire-extinguishing stations shall be indicated by a plate with the symbol used on *Fire Control Plan*.

### **3.8.4 Fire Control Stations**

**3.8.4.1** Each fire control station shall be provided with the following:

- a fire hose nozzle;
- a rigid, non-kinkable hose up to 33 m in length;
- cylinders for remote activation of the system;

or alternatively:

- a monitor;
- cylinders for remote activation.

**3.8.4.2** The fire control station equipment, except for the monitor, shall be stored in a watertight box or locker.

**3.8.4.3** The fire hose nozzle shall be equipped with a device for the opening and closing the passage.

**3.8.4.4** The passage area of the fire hose nozzle shall be equal to the hose passage area or less, but not more than by 50%.

**3.8.4.5** Starting cylinders shall be equipped with pressure gauges.

**3.8.4.6** The system activation instructions shall be available at the fire control station.

**3.8.4.7** The system control station shall be indicated by a plate with the symbol used on *Fire Control Plan*.

### **3.8.5 Containers, Pipings and Fittings**

**3.8.5.1** Container shall be provided with a scarfed pipe with its end being at a distance of about 100 mm from the container bottom.

**3.8.5.2** Arrangement for the supply of gas to the lower part of the container shall be provided with a device preventing the powder from penetrating into the gas piping.

**3.8.5.3** The powder filling ratio shall be taken not greater than 0.95.

**3.8.5.4** The pipings and fittings of the system shall not have contractions or sudden increase of the passage area.

**3.8.5.5** The cross-sectional area of the manifold in the fire-extinguishing station shall be not less than the sum and not greater than the double sum of the sectional areas of pipings connected to the manifold through which the powder may be simultaneously supplied.

**3.8.5.6** The distributing manifold of the system in the fire-extinguishing station shall be provided with means for blowing through the pipes after the use of the system.

**3.8.5.7** The bending radius of the powder system pipings shall be not less than  $10d$ , where  $d$  is the outer diameter of the pipe.

**3.8.5.8** To spaces such as emergency power units rooms, emergency fire pump rooms, as well as store-rooms, garages and hangars, the powder shall be delivered by means of spray nozzles, the design, number and arrangement of which shall ensure an uniform powder coverage throughout the space. The pressure at the most remote spray nozzles shall be equal to at least the minimum pressure sufficient for an effective powder coverage.

### **3.9 Fixed Deck Foam System (for Use in Tankers)**

#### **3.9.1 General Requirements**

**3.9.1.1** The system shall consist of foam concentrate tank, water supply pump, foam pump and foam proportioner, water supply pipes, as well as foam monitors and manual foam applicators.

Generally, the deck foam systems shall be designed for low-expansion foam; however, after appropriate tests, medium-expansion foam may be permitted. Definitions relating to foam system – see 3.5.2.

**3.9.1.2** The arrangements for generating foam shall be capable of delivering foam to the entire cargo tanks area, as well as into any cargo tank, the deck of which has been ruptured.

**3.9.1.3** The deck foam system shall be capable of simple and rapid operation.

**3.9.1.4** The deck foam system and the water fire main system can be supplied from the common line. However, operation of the deck foam system at its required output shall permit the simultaneous use of the minimum required jets of water at the required pressure from the fire main on the open deck over the full length of the ship in accommodation spaces, service spaces, control stations and machinery spaces.

If the deck foam system and the water fire main system are to be supplied from the common line, additional foam concentrate shall be provided for operation of 2 hose nozzles for the same period of time as is required for the foam system.

A common line for the water fire main system and deck foam system can only be accepted if it can be demonstrated that the hose nozzles can be effectively controlled by one person when supplied from the common line at a pressure needed for operation of the monitors.

**3.9.1.5** The main control station for the system shall be suitably located outside the cargo area, in the vicinity of the accommodation spaces and readily accessible and operable in the event of fire in the areas protected.

The location of the main control station shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.9.1.6** The major foam system equipment, such as the foam concentrate tanks and the pumps shall be located outside cargo area but may be located in the machinery space.

The location of the foam concentrate tanks shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**3.9.1.7** Means shall be provided for the crew to safely check the quantity of foam concentrate in the tanks and taking the foam concentrate samples for the periodical

checking of its quality. The minimum level/required quantity of foam concentrate shall be marked on the tank.

### 3.9.2 Foam Concentrate Requirements

#### 3.9.2.1 For tankers carrying:

- .1 crude oil or petroleum products having a flash-point not exceeding 60 °C (closed cup test), as determined by an approved flash-point apparatus, and a Reid vapour pressure which is below atmospheric pressure or other liquid products of similar fire-hazard, including the cargoes listed in Chapter 18 of the *IBC Code* having a flash-point not exceeding 60 °C (closed cup test) for which a regular foam fire-extinguishing system is effective; or
- .2 petroleum products having a flash-point exceeding 60 °C (closed cup test), as determined by an approved flash-point apparatus; or
- .3 products listed in Chapter 17 of the *IBC Code* having a flash-point exceeding 60 °C (closed cup test), as determined by an approved flash-point apparatus;

the rate of supply of foam solution shall be not less than the greatest of the following:

- .1 0.6 l/min 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; or
- .2 6 l/min per square metre of the horizontal sectional area of the single tank having the largest such area; or
- .3 3 l/min per square metre of the deck area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1250 l/min.

**3.9.2.2** For tankers carrying chemicals in bulk, listed in Chapter 17 of the *IBC Code*, having a flash-point not exceeding 60 °C (closed cup test), the rate of supply of foam solution shall be as specified in the *IBC Code*.

**3.9.2.3** Sufficient foam concentrate shall be supplied to ensure at least 20 min of foam generation – in tankers fitted with inert gas installation or 30 min of foam generation – in tankers not fitted with inert gas installation or when inert gas installation is not required.

If the deck foam system and the water fire main system are to be supplied from the common line, additional foam concentrate shall be provided on board, see 3.9.1.3.

**3.9.2.4** Foam concentrate used in the foam system shall be type approved in accordance with MSC/Circ. 1312/Corr.1 and shall be suitable for extinguishing the carried flammable cargoes. For extinguishing crude oil, petroleum products and non-polar solvents, type B foam concentrates shall be used. Type A foam concentrates (alcohol resistant) shall be used for extinguishing polar solvents, listed in Chapter 17 of the *IBC Code*.

Only one type of foam concentrate shall be used on board and it shall be effective for extinguishing the greatest possible amount of the carried cargoes.

Cargoes for which foam is not effective, additional fire protection shall be provided in accordance of the *IBC Code*.

**3.9.2.5** Liquid cargoes having a flash-point not exceeding 60 °C for which regular foam is not effective shall be fire protected in accordance with the *IBC Code*.

### **3.9.3 Monitors and Foam Applicators**

**3.9.3.1** Foam from the fixed deck foam system shall be supplied by means of monitors and foam applicators.

At the system acceptance on board, tests of foam monitors and applicators shall be carried out to ensure that the foam expansion ratio and drain time do not differ by more than  $\pm 10\%$  from the values required for the used foam, specified in 3.9.2.4. If medium-expansion foam is used in the fire-extinguishing system (expansion ratio between 21 and 200), the foam solution supply rate and the capacity of monitors shall be specified for the given ship separately in each particular case.

At least 50% of the required foam solution supply rate shall be delivered from each monitor.

In tankers of less than 4000 tonnes deadweight, installation of monitors may not be required and the use of applicators only may be permitted. However, in such case the capacity of each applicator shall be at least 25% of the required foam solution supply rate.

**3.9.3.2** The number and position of monitors shall be such as to comply with the requirements specified in 3.9.1.2.

**3.9.3.3** The distance from the monitor to the farthest extremity of the protected area forward of that monitor shall be not more than 75 % of the monitor throw in still air conditions.

**3.9.3.4** A monitor and hose connection for a foam applicator shall be situated both port and starboard at the front of the poop or accommodation spaces facing the cargo tanks deck.

Port and starboard monitors may be located in the cargo area, provided they are aft of cargo tanks and that they protect below and aft of each other.

In tankers of less than 4000 tonnes deadweight, a hose connection for a foam applicator shall be situated both port and starboard at the front of the poop or accommodation spaces facing the cargo tanks deck.

**3.9.3.5** Applicators shall be provided to ensure flexibility of action during fire-fighting operations and to cover areas screened from the monitors.



**3.9.3.6** The capacity of any applicator shall be not less than 400 l/min and the applicator throw in still air conditions shall be not less than 15 m.

**3.9.3.7** Each tanker shall be provided with at least four applicators in accordance with 3.9.3.6. The number and arrangement of hose connections for a foam applicator shall be such that foam from at least two applicators can be directed on to any part of the cargo tanks deck area.

The requirements of the present paragraph are applicable to all tankers, regardless of their size.

The location of each foam applicator shall be indicated by a plate with the symbol used on *Fire Control Plan*.

### **3.9.4 Isolating Valves**

Valves shall be provided in the foam main and in the water 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.

The location of each isolating valve shall be indicated by a plate with the symbol used on *Fire Control Plan*.

## **3.10 Inert Gas System (for Use in Tankers)**

### **3.10.1 General Requirements**

**3.10.1.1** The purpose of the inert gas system is to maintain the atmosphere of the cargo tanks non-flammable at all times, except when such tanks are required to be gas-free.

The inert gas system shall be designed, constructed and tested in accordance with guidelines specified in MSC/Circ. 353, MSC/Circ. 387, as well as MSC/Circ.450/Rev.1. Standards for the design, testing and location of the devices to prevent the passage of flame into cargo tanks in tankers are given in MSC/Circ.677, MSC/Circ.1009 and MSC.1/Circ.1324.

**3.10.1.2** The system shall be capable of:

- .1** inerting empty cargo tanks by reducing the oxygen content of the atmosphere in each tank to a level at which combustion cannot be supported;
- .2** maintaining the atmosphere in any part of any cargo tank with an oxygen content not exceeding 8% by volume and at a positive pressure at all times in port and at sea except when it is necessary for such a tank to be gas-free;
- .3** eliminating the need for air to enter a tank during normal operations except when it is necessary for such tank to be gas-free; and
- .4** purging empty cargo tanks of a hydrocarbon gas so that subsequent gas-freeing operations will at no time create a flammable atmosphere within a tank.

**3.10.1.3** The inert gas system shall consist of inert gas generators, scrubbers, blowers, water seal, the inert gas supply main fitted with an isolating valve and non-return device, branch piping supplying gas to cargo tanks and double hull spaces, as well as automatic arrangement, indication and alarm devices allowing to continuously indicate and record the inert gas parameters.

**3.10.1.4** Those parts of scrubbers, blowers, non-return devices, scrubber effluent and other drain pipes which may be subjected to corrosive action of the gases and/or liquids shall be either constructed of corrosion-resistant material or lined with rubber, glass fibre epoxy resin or other equivalent coating material.

### **3.10.2 Supply of Inert Gas**

**3.10.2.1** The inert gas supply may be treated flue gas from main or auxiliary boilers. Systems using flue gases from one or more separate gas generators or other sources or any combination thereof may be accepted by PRS, provided that an equivalent standard of safety is achieved. Systems using stored carbon dioxide shall not be permitted owing to the risk of ignition from generation of static electricity by the system itself.

**3.10.2.2** The system shall be capable of delivering inert gas to the cargo tanks at a rate of at least 125% of the maximum rate of discharge capacity of the ship expressed as a volume.

**3.10.2.3** The system shall be capable of delivering inert gas with an oxygen content of not more than 5% by volume in the inert gas supply main to the cargo tanks at any required rate of flow.

### **3.10.3 Scrubbers**

**3.10.3.1** A flue gas scrubber shall be fitted which will effectively cool the volume of gas specified in 3.10.2.2 and 3.10.2.3 and remove solids and sulphur combustion products. The cooling water arrangements shall be such that an adequate supply of water will always be available without interfering with any essential services on the ship. Provision shall be also made for an alternative supply of cooling water.

**3.10.3.2** Filters or equivalent devices shall be fitted to minimize the amount of water carried over to the inert gas blowers.

**3.10.3.3** Scrubbers shall be located aft of all cargo tanks, cargo pump-rooms and cofferdams separating these spaces from machinery spaces of category A.

### **3.10.4 Blowers**

**3.10.4.1** At least two blowers shall be fitted and be capable of delivering to the cargo tanks at least the volume of gas required in 3.10.2.2 and 3.10.2.3. Only one

blower may be permitted by PRS if the system is capable of delivering the total volume of gas required in 3.10.2.2 and 3.10.2.3 to the protected cargo tanks, provided that sufficient spares for the blower and its prime mover are carried on board to enable any failure of the blower and its prime mover to be rectified by the ship's crew.

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

**3.10.4.2** The inert gas system shall be so designed that the maximum pressure which it can exert on any cargo tank will not exceed the test pressure of any cargo tank. Suitable shutoff arrangements shall be provided on the suction and discharge connections of each blower. Arrangements shall be provided to enable the functioning of the inert gas plant to be stabilized before commencing cargo discharge. If the blowers are to be used for gas-freeing, their inlets shall be provided with blanking arrangements.

**3.10.4.3** The blowers shall be located aft of all cargo tanks, cargo pump-rooms and cofferdams separating these spaces from machinery spaces of category A.

### **3.10.5 Water Seals**

**3.10.5.1** The water seals, required in 3.10.9.1, shall be capable of being supplied by two separate pumps, each of which shall be capable of maintaining an adequate water supply at all times.

**3.10.5.2** The arrangement of the water seal and its associated fittings shall be such that it will prevent backflow of hydrocarbon vapours and will ensure the proper functioning of the seal under operating conditions.

**3.10.5.3** Provision shall be made to ensure that the water seal is protected against freezing in such a way that the integrity of the seal is not impaired by overheating.

**3.10.5.4** A water loop or other approved arrangement shall also be fitted to each associated water supply and drain pipe and each venting or pressure-sensing pipe leading to gas-safe spaces<sup>1)</sup>. Means shall be provided to prevent such loops from being emptied by vacuum.

**3.10.5.5** The deck water seal and loop arrangements shall be capable of preventing return of hydrocarbon vapours at a pressure equal to the test pressure of the cargo tanks.

**3.10.5.6** In respect of paragraph in 3.10.15.1.7, provision shall be made, to the satisfaction of PRS, for the maintenance of an adequate reserve of water at all

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<sup>1)</sup> A gas-safe space is a space in which the entry of hydrocarbon gases would produce hazards with regard to flammability or toxicity.

times and the integrity of the arrangements to permit the automatic formation of the water seal when the gas flow ceases. The signal alarm on the low level of water in the water seal shall operate when the inert gas is not being supplied.

### **3.10.6 Flue Gas Isolating Valves**

Flue gas isolating valves shall be fitted in the inert gas supply mains between the boiler uptakes and the flue gas scrubber. These valves shall be provided with indicators to show whether they are open or shut. Precautions shall be taken to maintain the valves gastight and keep the seatings clear of soot.

Arrangements shall be made to ensure that boiler soot blowers cannot be operated when the corresponding flue gas isolating valve is open.

### **3.10.7 Prevention of Flue Gas Leakage**

**3.10.7.1** Special consideration shall 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.

**3.10.7.2** To permit safe maintenance, an additional water seal or other effective means of preventing flue gas shall be fitted between the flue gas isolating valves and scrubber or incorporated in the gas entry to the scrubber.

### **3.10.8 Gas Regulating Valves**

**3.10.8.1** A gas regulating valve shall be fitted in the inert gas supply main. This valve shall be automatically controlled to close as required in 3.10.10. It shall also be capable of automatically regulating the flow of inert gas to the cargo tanks unless means are provided to automatically control the speed of the inert gas blowers required in 3.10.4.

**3.10.8.2** The inert gas regulating valve shall be located at the forward bulkhead of the forward most gas-safe space through which the inert gas supply main passes.

### **3.10.9 Non-Return Devices of Flue Gas**

**3.10.9.1** At least two non-return devices, one of which shall be a water seal, shall be fitted in the inert gas supply main, in order to prevent the return of hydrocarbon vapours to the machinery space uptakes or to any gas-safe spaces under all normal conditions of trim, list and motion of the ship. They shall be located between the gas regulating valve required in 3.10.8.1 and the aftermost connection to any cargo tank or cargo pipeline.

**3.10.9.2** Non-return devices shall be located in the cargo deck area.

**3.10.9.3** The second device shall be a non-return valve or equivalent capable of preventing the return of vapours or liquids and fitted forward of the deck water seal

specified in 3.10.9.1. It shall be provided with positive means of closure. As an alternative to positive means of closure, an additional valve having such means of closure may be provided forward of the non-return valve to isolate the deck water seal from the inert gas main to the cargo tanks.

**3.10.9.4** As an additional safeguard against the possible leakage of hydrocarbon liquids or vapours back from the deck main, means shall be provided to permit this section of the line between the valve having positive means of closure, referred to in 3.10.9.3 and the gas regulating valve to be vented in a safe manner when the first of these valves is closed.

### **3.10.10 Automatic Shutdown**

**3.10.10.1** Automatic shutdown of the inert gas blowers and gas regulating valve shall be arranged on predetermined limits, specified in 3.10.15.1.1, 3.10.15.1.2 and 3.10.15.1.3, being reached.

**3.10.10.2** Automatic shutdown of the gas regulating valve shall be provided in the case specified in 3.10.15.1.4.

### **3.10.11 Oxygen Rich Gas**

When the oxygen content of the inert gas exceeds 8% by volume, the alarms (required in 3.10.15.1.5) shall be activated, cargo pumps automatically shut down and the isolating valve, referred to in 3.10.9.3, shall be closed.

### **3.10.12 Inert Gas Pipelines**

**3.10.12.1** The inert gas supply main may be divided into two or more branches forward of the water seal required in 3.10.5 and the non-return devices required in 3.10.9.

**3.10.12.2** The inert gas supply main shall be fitted with branch piping leading to each cargo tank and double hull tanks.

Each branch piping for inert gas shall be fitted with either stop valve or equivalent means of control for isolating each tank. Where stop valves or other isolating devices are fitted, they shall be provided with “open – closed” indicators and locking arrangements, which should be under control of a responsible ship’s officer.

**3.10.12.3** In combination carriers, the arrangement to isolate the slop tanks containing oil or oil residues from other tanks shall consist of blank flanges which will remain in position at all times when cargoes other than oil are being carried.

**3.10.12.4** Means shall be provided to protect cargo tanks against the effect of overpressure or vacuum caused by thermal variations when the cargo tanks are isolated from the inert gas supply main.

**3.10.12.5** Piping systems shall be so designed and constructed as to prevent the accumulation of cargo or water in the pipelines under all normal conditions.

**3.10.12.6** Arrangements shall be provided to enable the inert gas main to be connected to an external source of inert gas supply.

The arrangements shall 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 required in 3.10.9.3. The design of the flange shall conform to the appropriate class in the standards adopted for the design of other external connections in the ship's cargo piping.

**3.10.12.7** If a connection is fitted between the inert gas supply main and the cargo piping system, arrangements shall be made to ensure an effective isolation having regard to the large pressure difference which may exist between the systems. This shall consist of two shut-off 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<sup>1)</sup>.

**3.10.12.8** The valve separating the inert gas supply main from the cargo main and which is on the cargo main side shall be a non-return valve.

### **3.10.13 Indication Devices**

Means shall be provided for continuously indicating the temperature and pressure of the inert gas at the discharge side of the gas blowers, whenever the gas blowers are operating.

### **3.10.14 Indicating and Recording Devices**

**3.10.14.1** Instrumentation shall be fitted for continuously indicating and permanently recording, when the inert gas is being supplied:

- .1 the pressure of the inert gas supply mains forward of the non-return devices, required in 3.10.9.1;
- .2 the oxygen content of the inert gas in the inert gas supply main on the discharge side of the gas blowers.

**3.10.14.2** The devices, referred to in 3.10.14.1, shall be placed in the cargo control room, where provided. Where no cargo control room is provided, they shall be placed in a position easily accessible to the officer in charge of cargo operations.

**3.10.14.3** In addition, meters shall be fitted:

- .1 on the navigation bridge to indicate at all times the pressure in the inert gas supply main, referred to in 3.10.14.1.1 and the pressure in the slop tanks of

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<sup>1)</sup> An example of such arrangements is given in MSC/Circ.1120 for the *FSS Code* Chapter 15, paragraph 2.3.2.7.

combination carriers, whenever those tanks are isolated from the inert gas supply main; and

- .2 in the engine control room or in the machinery space to indicate the oxygen content of the inert gas in the gas supply main, referred to in 3.10.14.1.2.

### **3.10.15 Audible and Visual Alarms**

**3.10.15.1** For inert gas systems of both the flue gas type and the inert gas generator type, audible and visual alarms shall be provided to indicate:

- .1 low water pressure or low flow rate to the flue gas scrubber, referred to in 3.10.3;
- .2 high water level in the flue gas scrubber, referred to in 3.10.3;
- .3 high gas temperature, see 3.10.13;
- .4 failure of the inert gas blowers, referred to in 3.10.4;
- .5 oxygen content in excess of 8% by volume, see 3.10.14.3.2;
- .6 failure of the power supply to the automatic control system for the gas regulating valve, referred to in 3.10.8 and to the indicating and recording devices, referred to in 3.10.14;
- .7 low water level in the water seal, referred to in 3.10.9.1;
- .8 gas pressure lower than 1 kPa, see 3.10.14.1.1. The alarm shall be such as to ensure that the pressure in slop tanks in combination carriers can be monitored at all times;
- .9 high gas pressure, referred to in 3.10.14.1.1.

**3.10.15.2** For inert gas systems of the inert gas generator type, additional audible and visual alarms shall be provided to indicate:

- .1 insufficient fuel oil supply;
- .2 failure of the power supply to the gas generator; and
- .3 failure of the power supply to the automatic control system for the generator.

**3.10.15.3** The alarms, required in 3.10.15.1.5, 3.10.15.1.6 and 3.10.15.1.8, shall 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.

**3.10.15.4** An audible low gas pressure alarm independent of that required in 3.10.15.1.8 or automatic shutdown of cargo pumps shall be provided to operate on predetermined limits of low pressure in the inert gas main being reached.

### **3.10.16 Operating Manuals**

Detailed operating manuals shall be provided on board, covering the operation, safety and maintenance requirements and occupational health hazards relevant to the inert gas system. The manual shall contain guidance on procedures to be followed in the event of a fault or failure of the inert gas system. The operating

manuals shall be prepared in accordance with guidelines for inert gas systems, specified in IMO MSC/Circ.353, as amended by MSC/Circ.387.

### **3.10.17 Inert Gas System with Oil Fired Inert Gas Generator**

**3.10.17.1** In the case of inert gas system with oil fired inert gas generator, the following additional requirements shall be complied with:

- .1** two fuel oil pumps shall be fitted to the inert gas generator. Installation of only one fuel oil pump may be permitted by PRS, provided that sufficient spares for the oil pump and its prime mover are carried on board to enable any failure of the fuel oil pump and its prime mover to be rectified by the ship's crew;
- .2** the compartment in which oil fired inert gas generator is situated shall be regarded, with respect to fire protection, as machinery space of category A;
- .3** arrangements shall be provided to vent the inert gas from oil fired gas generators to the atmosphere when the inert gas produced is off specification, e.g. during start-up or in the event of equipment failure;
- .4** automatic shutdown of the oil fuel supply to inert gas generators shall be arranged on predetermined limits being reached with respect to low water pressure or low water flow rate to the cooling and scrubbing arrangement (the scrubber) and with respect to high gas temperature;
- .5** automatic shutdown of gas regulating valve shall be arranged with respect to failure of the power supply to the oil fired inert gas generator.

The space with inert gas generator shall be indicated, on the access door, by a plate with the symbol used on *Fire Control Plan*.

### **3.10.18 Nitrogen Generator System**

**3.10.18.1** The requirements of the present sub-chapter are applicable exclusively to the gas generator system where inert gas is produced by separating air into its component gases by passing compressed air through a bundle of hollow fibres, semi-permeable membranes or adsorber materials.

**3.10.18.2** With respect to the piping arrangements, alarms and instrumentation downstream of the gas generator, the requirements for inert gas generator, specified in 3.10, shall apply.

In particular, the requirements specified in 3.10.8.1, 3.10.8.2, 3.10.10, 3.10.12, 3.10.14, 3.10.15.1.6, 3.10.15.1.8, 3.10.15.1.9, 3.10.15.3, 3.10.15.4, 3.10.16 shall be complied with.

**3.10.18.3** A nitrogen gas generator shall consist of a feed air treatment system and any number of membrane or adsorber modules in parallel necessary to meet the required capacity which shall be at least 125% of the maximum discharge capacity of the ship expressed as a volume.



**3.10.18.4** The air compressor and the nitrogen generator may be installed in the machinery space or in a separate compartment. A separate compartment shall be treated as machinery space other than category A with respect to fire protection.

The space with inert gas generator shall be indicated, on the access door, by a plate with the symbol used on *Fire Control Plan*.

**3.10.18.5** Where a separate compartment is provided, it shall be situated outside the cargo area and shall be fitted with an independent mechanical extraction ventilation system providing 6 air changes per hour. The compartment shall be also fitted with a low oxygen level alarm.

The compartment shall have no direct access to accommodation spaces, service spaces and control stations.

**3.10.18.6** The nitrogen generator shall be capable of delivering high purity nitrogen with O<sub>2</sub> content not exceeding 5% by volume. The system shall be fitted with automatic means to discharge “off-spec” gas to the atmosphere during start-up and abnormal operation.

**3.10.18.7** The system shall be fitted with two air compressors. It is recommended that the total required capacity of the system 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.

Only one compressor may be accepted, provided that sufficient spares for the air compressor and its prime mover are carried on board to enable their failure to be rectified by the ship's crew.

**3.10.18.8** A feed air treatment system shall be fitted to remove free water, particles and traces of oil from the compressed air and to maintain the required temperature.

**3.10.18.9** Where a nitrogen tank is fitted, it may be installed in a separate compartment or in a compartment containing the air compressor and the generator, or may be located in the cargo area. Where the nitrogen tank is installed in an enclosed space, the access shall be arranged only from the open deck and the access door shall open outwards. The space shall be fitted with an independent mechanical extraction ventilation system providing 6 air changes per hour. A low oxygen alarm shall be also fitted.

**3.10.18.10** The oxygen-enriched air from the nitrogen generator and the nitrogen-product enriched gas from the protective devices of the nitrogen receiver shall be discharged to a safe location on the open deck.

**3.10.18.11** In order to permit maintenance, an isolating valve shall be fitted between the generator and the receiver.

**3.10.18.12** Two non-return devices shall be fitted in the inert gas supply main, one of which shall be an arrangement consisting of two shut-off valves in series with a venting valve in between (double block and bleed), the following requirements being complied with:

- .1 the operation of the valves shall be automatically executed. Signal for opening/closing of the valve shall be taken from the process directly, e.g. inert gas flow or differential pressure;
- .2 alarm for faulty operation of the valves shall be provided, e.g. the operation status when the supply valves are open while the blower is stopped, is an alarm condition.

The second non-return device shall be a non-return shut-off device, fitted with open/closed indicator.

**3.10.18.13** The system shall be provided with instruments continuously indicating the temperature and pressure of air:

- .1 at the discharge side of the compressor;
- .2 at the entrance side of the nitrogen generator.

**3.10.18.14** The system shall be fitted with instruments continuously indicating and recording the oxygen content of the inert gas downstream of the nitrogen generator when inert gas is being supplied.

**3.10.18.15** The instruments, referred to in 3.10.18.14, shall be placed in the cargo control room. Where no cargo control room is provided, they shall be placed in position easily accessible to the officer in charge of cargo operations.

**3.10.18.16** Audible and visual alarms shall be provided to indicate:

- .1 low air pressure at the discharge side of compressor – see 3.10.18.13.1;
- .2 high air temperature at the discharge side of compressor – see 3.10.18.13.1;
- .3 high condensate level at automatic drain of water separator – see 3.10.18.8;
- .4 failure of electrical heater, if fitted;
- .5 oxygen content in excess of 5% by volume – see 3.10.18.6;
- .6 failure of the power supply to the instruments – see 3.10.18.14.

**3.10.18.17** Automatic shut-down of the system shall be arranged upon alarm conditions specified in 3.10.18.16.1 to .5.

**3.10.18.18** The alarms, required in 3.10.18.16, shall be fitted in the machinery space and cargo control room, where provided, in such position that they are immediately received by responsible members of the crew.

**3.10.18.19** For nitrogen generator system fitted in tankers of less than 20 000 tonnes deadweight, in gas tankers or chemical tankers, the requirements specified in 3.10.18.1, 3.10.18.2, 3.10.18.3 and 3.10.18.7 need not be complied with.

Where the connections to the cargo tanks, to the hold spaces or to cargo piping are not permanent, the non-return devices, required in 3.10.18.12, may be substituted by two non-return valves.

### 3.11 Tests of Fire-Extinguishing Systems and Inert Gas Systems

**3.11.1** The scope of workshop tests and the tests on completion of pipelines installation on board, as well as test pressure values for fire-extinguishing systems and inert gas systems shall be determined in accordance with Table 3.11.

**3.11.2** Flexible pipes and attachments, used in fire-extinguishing systems, which are required to be fire-resistant materials, shall be subjected to fire test for 30 minutes at a temperature 800 °C, while at the maximum service pressure water is circulated inside the pipe. The temperature of the outlet shall not be less than 80 °C. No leak should be recorded during or after the tests.

An alternative is to fire test of the flexible pipe with flowing water at a pressure of at least 0.5 MPa and subsequently pressure test to twice the design pressure.

**3.11.3** Fire hydrants, used in water fire main, made form components or materials liable to be damaged or destroyed by heat fire are subject to fire test which shall be conducted in two stages:

- dry test – the valve shall be put into a furnace and tested for 10 minutes at a temperature of 250 °C;
- test under water working pressure – the valve connected to the water supply piping shall be put into a furnace and tested for 30 minutes at a temperature of 540 °C.

The fire test is considered satisfactory if on completion of two stages of the test, the fire hydrant functions properly.

**Table 3.11**  
**Scope of pressure tests and test pressure values for fire-extinguishing systems and inert gas systems**

Item	Systems to be tested	Test pressure	
		In workshop	On board ship
1	2	3	4
1	Water and foam fire-extinguishing systems (see also sub-chapter 1.5.4, <i>Part VI – Machinery Installations and Refrigerating Plants</i> ):		
	.1 pipes of water fire main systems, water-spraying systems and sprinkler systems,	–	1.25 p
	.2 pipes of high pressure water-spraying systems and sprinkler systems (water mist),	1.5 p	1.25 p
	.3 pipes of foam systems.	–	1.25 p
2	Pipes of dry powder chemical systems	1.5 p	1.25 p (air test)

1	2	3	4
3	Carbon dioxide fire-extinguishing system		
3.1	High pressure carbon dioxide system: .1 pipes from cylinders to distribution valves (manifold), .2 pipes from distribution valves to the protected spaces and pipes from safety valves passing through accommodation and service spaces, .3 remote control pilot lines pipes from pilot cylinders to distribution valves/cylinder valves, .4 pipes passing through spaces other than accommodation spaces and service spaces and pipes in the protected space.	1.5 <i>p</i> – 1.3 <i>p</i> –	19.0 MPa 5.0 MPa 1.3 <i>p</i> (nitrogen test) 1.0 MPa
3.2	Low pressure carbon dioxide system: .1 pipes from storage tanks to distribution valves, .2 pipes from distribution valves to protected spaces; pipes from safety valves, .3 pipes in the protected space.	– – –	1.5 <i>p</i> ( <i>zb</i> ) 1.25 <i>p</i> ( <i>zb</i> ) 1.0 MPa
4	Pipes and scrubber of inert gas system (in tankers)	–	1.25 <i>p</i> (air test)
5	Pipes of equivalent gas fire-extinguishing systems	1.5 <i>p</i>	1.25 <i>p</i> (air test)
6	Compressed air pipes	1.5 <i>p</i>	1.25 <i>p</i> (air test)
7	Cylinders, storage tanks and containers: .1 pressurized (including cylinders without valves) .2 non-pressurized, .3 cylinders with valves fitted.	1.5 <i>p</i> by filling up to the top of air vent pipe 1.25 <i>p</i> (air test)	– together with the whole system –
8	Fittings – pressure and strength tests	1.5 <i>p</i> (but at least 0.2 MPa)	–

**Notes to Table 3.11:**

- 1) The value *p* in the Table means the maximum working pressure in the system, *p*(*zb*) means the tank safety valve setting pressure. For carbon dioxide system, *p* is equal to the design pressure in the cylinder or in the storage tank.
- 2) Complete fittings shall be subjected to hydraulic test with a pressure of at least 1.25 *p*. Carbon dioxide cylinders valves shall be tested for tightness to maximum breaking pressure of the bursting disk – according to 3.6.4.3.3.
- 3) The systems shall be tested in assembly on board ship, upon completion of all installation work.
- 4) Pipes of water fire main systems in ships of 500 gross tonnage and upwards shall be tested for tightness to a pressure of at least 1.0 MPa.

## **4 FIRE SIGNALLING SYSTEMS AND HYDROCARBON GAS DETECTION SYSTEM**

### **4.1 Fixed Fire Detection and Fire Alarm System**

#### **4.1.1 Definitions**

- .1** Section – a group of fire detectors and manually operated call points as reported in the indicating unit.
- .2** Section identification capability – a system with the capability of identifying the section in which a detector or manually operated call point has activated.
- .3** Individually identifiable – a system with the capability to identify the exact location and type of detector or manually operated call point which has activated, and which can differentiate the signal of that device from all others.
- .4** Loop – an electrical circuit linking detectors of various sections and connected to the control panel.

#### **4.1.2 General Requirements**

**4.1.2.1** Any required fixed fire detection and fire alarm system shall consist of fire detectors, manually operated call points and the control panel. The system shall be capable of immediate operation at all times (this does not require a back-up 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 shall be so designed as to automatically restore the system to normal surveillance after a pre-determined time that is appropriate for the operations in question. The space shall be manned or provided with patrol when the required detectors are disconnected. The detectors in all other compartments shall remain operational.

**4.1.2.2** Where a fixed fire detection and fire alarm system is required for the protection of spaces other than stairways, corridors and escape routes, at least one detector shall be installed in each such space.

**4.1.2.3** Fixed fire detection and fire alarm system shall be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of the protected spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures.

**4.1.2.4** Except in spaces of restricted height and where their use is particularly appropriate, detection and alarm systems using only thermal detectors are not permitted.

**4.1.2.5** Smoke detectors shall be installed in all stairways, corridors and escape routes within accommodation spaces. It is recommended that special purpose smoke detectors be installed within ventilation ducting where smoke may occur as a factor indicative of incipient fire.

**4.1.2.6** Manually operated call points shall be installed throughout the accommodation spaces, service spaces and control stations, but it is not required that they be fitted in an individual space within these spaces. One manually operated call point shall be located at each exit. Manually operated call points shall be located in the corridors of each deck at each exit (inside or outside) to the open deck and be readily accessible from the corridor such that no part of the corridor is more than 20 m from a manually operated call point.

Service spaces and control stations which have only one access, leading directly to the open deck, shall have a manually operated call point not more than 20 m (measured along the access route using the deck, stairs and/or corridors) from the exit.

Manually operated call points are not required to be installed for spaces having little or no fire risk, such as void spaces and carbon dioxide rooms, nor at each exit from the navigation bridge, in cases where the control panel is located on the navigation bridge.

The location of each manually operated call point shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**4.1.2.7** Fixed fire detection and fire alarm system shall be designed to:

- .1** control and monitor input signals from all the connected fire and smoke detectors and manually operated call points;
  - .2** provide output signals to the navigation bridge, continuously manned 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;
- additionally:
- .4** the system may be arranged with output signals to other fire safety systems including:
    - .1** paging systems, fire alarm or public address systems;
    - .2** fan stops;
    - .3** fire doors<sup>1)</sup>;
    - .4** fire dampers;
    - .5** automatic sprinkler systems;
    - .6** smoke extraction systems;
    - .7** low-location lighting systems;

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<sup>1)</sup> Watertight doors which also serve as fire doors shall not be closed automatically in case of fire detection.

- .8 fixed local application fire-extinguishing systems;
- .9 CCTV system; and
- .10 other fire safety systems.

**4.1.2.8** The fire detection and fire alarm 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 sub-chapter for the fire detection system;
- .3 any malfunction of the interfaced and connected equipment will not propagate under any circumstance to the fire detection system.

**4.1.2.9** Detectors and manually operated call points shall 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 provided in separate sections.

**4.1.2.10** Fixed fire detection and fire alarm system shall be so designed as 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 shall be tested for electromagnetic compatibility in accordance with Res. A.813(19).

**4.1.2.11** Fixed fire detection and fire alarm systems with a zone address identification capability shall be so arranged that:

- .1 means are provided to ensure that any fault (e.g. power break, short circuit, earth, etc.) occurring in the loop will not render the whole loop ineffective;
- .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 loop will pass through a space twice. When this is not practicable (e.g. for large public spaces), the part of the loop which by necessity passes through the space for a second time shall be installed at the maximum possible distance from the other parts of the loop.

**4.1.2.12** In cargo ships, the fixed fire detection and fire alarm system shall be, as a minimum, capable of identifying each loop.

**4.1.2.13** Spaces/group of spaces covered by the fixed fire detection and alarm system shall be marked by a plate, placed at access door, with the symbol used on *Fire Control Plan*.

### 4.1.3 Sources of Power Supply

**4.1.3.1** There shall 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 shall be an emergency source. The supply shall be provided by separate feeders reserved solely for that purpose. Such feeders shall run to an automatic changeover switch situated in or adjacent to the control panel for the fire detection system. The changeover switch shall be so designed that its failure will not cut off the source of power supply. The main feeder (and the corresponding emergency feeder) shall run from the switchboard to the changeover switch avoiding another switchboard.

**4.1.3.2** The operation of the automatic changeover switch or a failure of one of the power supply sources shall not cause loss of fire detection capability. Where a momentary loss of power would cause degradation of the system, a battery of adequate capacity shall be provided to ensure continuous operation during changeover.

**4.1.3.3** There shall 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.

**4.1.3.4** In cargo ships, the emergency source of power specified in 4.1.3.1 shall be supplied by accumulators batteries or from the emergency switchboard. The source of power shall be sufficient to maintain the operation of the fire detection and fire alarm system for the periods required in sub-chapter 9.3, *Part VIII – Electrical Installations and Control Systems*, and at the end of that period, shall be capable of operating all connected visual and audible fire alarm signals for a period of at least 30 min.

**4.1.3.5** Where the fire detection system is supplied from accumulators batteries, the accumulator battery shall 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 shall be sufficient to maintain the normal output power supply to the fire detection system while recharging the batteries from a fully discharged condition.

### 4.1.4 Component Requirements

#### 4.1.4.1 Detectors

**4.1.4.1.1** Detectors shall be operated by heat, smoke or other products of combustion, flame, or any combination of these factors. Detectors operated by other factors indicative of incipient fires may be accepted, provided that they are not less sensitive than such detectors.



**4.1.4.1.2** Smoke detectors required in all stairways, corridors and escape routes within accommodation spaces shall be certified to operate before the smoke density exceeds 12.5% obscuration per metre, but not until the smoke density exceeds 2% obscuration per metre, when tested according to EN 54:2001 and IEC 60092-504. Alternative national standards may be used. Smoke detectors to be installed in other spaces shall operate within sensitivity limits recommended by the manufacturer having regard to the avoidance of detector insensitivity or oversensitivity.

**4.1.4.1.3** Heat detectors shall be certified to operate before the temperature exceeds 78°C but not until the temperature exceeds 54°C, when the temperature is raised to those limits at a rate less than 1°C per min, when tested according to EN 54:2001 and IEC 60092-504. Alternative national standards may be used. At higher rates of temperature rise, the heat detector shall operate within temperature limits recommended by the manufacturer having regard to the avoidance of detector insensitivity or oversensitivity.

**4.1.4.1.4** Operation temperature of heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 130 °C, and to 140 °C in saunas.

**4.1.4.1.5** Flame detectors shall be tested in accordance with EN 54-10:2001 and IEC 60092-504. Alternative national standards are permitted.

**4.1.4.1.6** All detectors shall be of a type such that they can be tested for correct operation and restored to normal surveillance without the renewal of any component.

**4.1.4.1.7** Detectors fitted in hazardous areas, where there is a risk of explosion, shall be tested and type-approved for such service. Detectors installed in special category spaces above the bulkhead deck need not be type-approved for service in hazardous areas. Detectors fitted in spaces carrying dangerous goods, listed in sub-chapter 2.10, Table 2.10-3, shall be suitable for service in hazardous areas in order to fulfil the requirements specified in sub-chapter 2.10.4.

**4.1.4.1.8** Detectors fitted in refrigerated spaces, such as refrigerated provision chambers, shall be tested in accordance with the relevant, for such spaces<sup>1</sup>, procedures.

#### **4.1.4.2 Control Panel**

The control panel for the fire detection system shall be tested in accordance with standards EN 54-2:1997, EN 54-4:1997 and IEC 60092-504:2001. Alternative national standards are permitted.

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<sup>1)</sup> See the guidelines of the International Electrotechnical Commission, in particular Publication IEC 60068-2-1 – Section one – Test Ab, *Environmental Testing – Part 2-1: Tests A: Cold*

### **4.1.4.3 Cables**

Cables used in the electrical circuits shall be flame-retardant in accordance with standard IEC 60332-1.

## **4.1.5 Installation Requirements**

### **4.1.5.1 Detector Sections**

**4.1.5.1.1** Detectors and manually operated call points shall be grouped into sections.

**4.1.5.1.2** The section of fire detectors which covers a control station, a service space or an accommodation space shall not include a machinery space of category A or a ro-ro space. The section of fire detectors which covers a ro-ro space shall not 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 stations shall not include fire detectors in machinery spaces of category A or ro-ro spaces.

**4.1.5.1.3** 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 shall 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 shall be limited and is subject to PRS' approval in each particular case. 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.

### **4.1.5.2 Positioning of Detectors**

**4.1.5.2.1** Detectors shall be located for optimum performance. Positions near beams and ventilation ducts, or other positions where patterns of air flow could adversely affect performance, and positions where impact or physical damage is likely, shall be avoided. Detectors shall be located on the overhead at a minimum distance of 0.5 m away from bulkheads, except in corridors, lockers and stairways.

**4.1.5.2.2** The maximum spacing of detectors shall be in accordance with the below Table:

**Table 4.1.5.2.2**  
**Spacing of detectors**

Item	Detector type	Maximum floor area per detector [m <sup>2</sup> ]	Maximum distance apart between centres [m]	Maximum distance from bulkheads [m]
1	Heat	37	9	4.5
2	Smoke	74	11	5.5

Other spacings based upon test data which demonstrate the characteristics of the detectors are permitted. Detectors located below moveable ro-ro decks shall be in accordance with the above requirement.

**4.1.5.2.3** Detectors in stairways shall be located at least at the top level of the stair and at every second level beneath.

**4.1.5.2.4** When fire detectors are installed in freezers, drying rooms, saunas, parts of galleys used to heat food, laundries and other spaces where steam or fumes are produced, heat detectors may be used.

**4.1.5.2.5** Where a fixed fire detection and fire alarm system is required within accommodation spaces and service spaces in accordance with 2.4.1, 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 (fire-extinguishing stations), 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.

### **4.1.5.3 Arrangement of Cables**

**4.1.5.3.1** Cables which form part of the system shall be so arranged as to avoid galleys, machinery spaces of category A, and other enclosed spaces of high fire risk except where it is necessary to provide for fire detection or fire alarms in such spaces or to connect them to the appropriate power supply.

**4.1.5.3.2** Section with individually identifiable capability shall be so arranged that it cannot be damaged at more than one point by a fire.

### **4.1.6 System Control Requirements**

#### **4.1.6.1 Visual and Audible Fire Detection Alarm Signals**

**4.1.6.1.1** Activation of any detector or manually operated call point shall initiate a visual and audible fire detection alarm signal at the control panel and indicating units. Alarm signals shall be in accordance with the *Code on Alarms and Indicators*

– Res. A.1021(26). If the signals have not been acknowledged within 2 min., an audible fire alarm shall be automatically sounded throughout the crew accommodation and service spaces, control stations and machinery spaces of category A. This alarm sounder system need not be an integral part of the detection system.

**4.1.6.1.2** Control panel shall be located on the navigation bridge or in the fire control station.

The location of each control panel shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**4.1.6.1.3** In cargo ships, an indicating unit shall be located on the navigation bridge if the control panel is located in the fire control station. Where a ship is provided with cargo control room, an indicating unit shall be located in this room. Indicating units shall, as a minimum, denote the section in which a detector has activated or manually operated call point has been operated.

**4.1.6.1.4** Clear information shall be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections.

**4.1.6.1.5** Power supplies and electric circuits necessary for the operation of the system shall be monitored for loss of power and fault conditions, as appropriate including:

- .1 a single open or power break fault caused by a broken wire;
- .2 a single ground fault caused by the contact of a wiring conductor with a metal component; and
- .3 a single wire to wire fault caused by the contact of two or more wiring conductors.

Occurrence of a fault condition shall initiate a visual and audible fault signal at the control panel which shall be distinct from a fire signal.

**4.1.6.1.6** Means to manually acknowledge all alarm and fault signals shall be provided at the control panel. Audible alarm sounders on the control panel and indicating units may be manually silenced. The control panel shall clearly distinguish between normal, alarm, acknowledged alarm, fault and silenced conditions.

**4.1.6.1.7** The system shall be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared.

**4.1.6.1.8** When the system is required to sound a local audible alarm within the cabins where the detectors are located, any means to silence the local audible alarms from the control panel are not permitted.

**4.1.6.1.9** In general, audible alarm sound pressure levels at the sleeping positions in the cabins and 1 m from the source shall 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 shall be in the 1/3 octave band about the fundamental frequency. Audible alarm signals shall not exceed 120 dB(A).

#### **4.1.7 Installation Tests**

**4.1.7.1** The function of fixed fire detection and fire alarm systems shall be tested under varying conditions of ventilation after installation on board.

**4.1.7.2** Suitable instructions, appropriate instruments for testing fire detectors, according to fire, as well as component spares for testing and maintenance shall be provided on board.

### **4.2 Sample Extraction Smoke Detection System (for Cargo Spaces)**

#### **4.2.1 General Requirements**

**4.2.1.1** Sample extraction smoke detection system is intended for installation in conventional cargo spaces in ships carrying dangerous goods in accordance with the requirements specified in 2.10, as well as in ro-ro spaces and vehicle spaces.

**4.2.1.2** Sample extraction smoke detection system shall consist of the following main components:

- .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 air stream 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.

**4.2.1.3** Any required system shall be capable of continuous operation at all times except that systems operating on a sequential scanning principle may be accepted, provided that the interval between scanning the same position twice depends on the number of scanning points and the response time of the fans.

The interval ( $I$ ) shall be determined with a 20% allowance in accordance with the following formula:

$$I = 1.2 \times T \times N \text{ [s]}$$

where:

$T$  – response time of the fans [s];

$N$  – the number of scanning points.

The maximum allowable interval between the two subsequent scans, however, shall not exceed 120 s ( $I_{max} = 120$  s).

**4.2.1.4** The system shall be so designed, constructed and installed 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.

**4.2.1.5** The system and its equipment shall be suitably designed to withstand supply voltage variations and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships and to avoid the possibility of ignition of a flammable gas-air mixture.

**4.2.1.6** The system shall be of a type that can be tested for correct operation and restored to normal surveillance without the renewal of any component.

**4.2.1.7** Alternative power supply for the electrical equipment used in the operation of the system shall be provided.

## **4.2.2 Component Requirements**

**4.2.2.1** The sensing unit shall be certified to operate before the smoke density within the sensing chamber exceeds 6.65% obscuration per metre.

**4.2.2.2** Duplicate sample extraction fans shall be provided. The fans shall be of sufficient capacity to operate with the normal conditions or ventilation in the protected area and the connected pipe size shall be determined with consideration of fan suction capacity and piping arrangement to satisfy the conditions specified in 4.2.5.2. Sampling pipes shall be a minimum of 12 mm internal diameter. The fan suction capacity shall be adequate to ensure the response of the most remote area within the required time criteria specified in 4.2.5.2. Means to monitor airflow shall be provided in each sampling line.

**4.2.2.3** Control panel shall permit observation of smoke in the individual sampling pipes.

**4.2.2.4** Sampling pipes shall be so designed as to ensure that, as far as practicable, equal quantities of airflow are extracted from each interconnected accumulator.

**4.2.2.5** Sampling pipes shall be provided with an arrangement for periodically purging with compressed air.

**4.2.2.6** Control panel for the smoke detection system shall be tested according to standards EN 54-2 (1997), EN 54-4 (1997) and IEC 60092-504 (2001). Alternative standards may also be used.

### **4.2.3 Installation Requirements**

#### **4.2.3.1 Smoke Accumulators**

**4.2.3.1.1** At least one smoke accumulator shall be located in every enclosed space for which smoke detection is required. However, where a space is designed to carry oil fuel 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 from the system. Such means are subject to PRS' approval in each particular case.

**4.2.3.1.2** Smoke accumulators shall be located on the overhead or as high as possible in the protected space, and shall be spaced so that no part of the overhead deck area is more than 12 m measured horizontally from an accumulator. Where such systems are used in spaces which may be mechanically ventilated, the position of the smoke accumulators shall be considered having regard to the effects of ventilation. At least one additional smoke accumulator shall be provided in the upper part of each exhaust ventilation duct. An adequate filtering system shall be fitted at the additional accumulator to avoid dust contamination.

**4.2.3.1.3** Smoke accumulators shall be positioned where impact or physical damage is unlikely to occur.

**4.2.3.1.4** Sampling pipe networks shall be balanced to ensure compliance with 4.2.2.4. The number of accumulators connected to each sampling pipe shall ensure compliance with 4.2.5.2.

**4.2.3.1.5** Smoke accumulators from more than one enclosed space shall not be connected to the same sampling pipe.

**4.2.3.1.6** In cargo holds where non-gastight “tween deck panels” (movable stowage platforms) are provided, smoke accumulators shall be located in both the upper and lower parts of the holds.

#### **4.2.3.2 Sampling Pipes**

**4.2.3.2.1** Sampling pipe arrangement shall be such that the location of the fire can be readily identified.

**4.2.3.2.2** Sampling pipes shall be self-draining and effectively protected from impact or damage from cargo working.

#### **4.2.4 System Control Requirements**

##### **4.2.4.1 Visual and Audible Fire Signals**

**4.2.4.1.1** Detection of smoke or other products of combustion shall initiate a visual and audible signal at the control panel and indicating units.

**4.2.4.1.2** Control panel shall be located on the navigation bridge or in the fire control station. An indicating unit shall be located on the navigation bridge if the control panel is located in the fire control station.

The location of control panel shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**4.2.4.1.3** Clear information shall be displayed on or adjacent to the control panel and indicating units designating the spaces covered.

**4.2.4.1.4** Power supplies necessary for the operation of the system shall be monitored for loss of power. Any loss of power shall initiate a visual and audible signal at the control panel and the navigating bridge which shall be distinct from a signal indicating smoke detection.

**4.2.4.1.5** Means to manually acknowledge all alarm and fault signals shall be provided at the control panel. The audible alarm sounders on the control panel and indicating units may be manually silenced. The control panel shall clearly distinguish between normal, alarm, acknowledged alarm, fault and silenced conditions.

**4.2.4.1.6** The system shall be so arranged as to automatically reset to the normal operating condition after alarm and fault conditions are cleared.

#### **4.2.5 Testing**

**4.2.5.1** Suitable instructions and component spares shall be provided on board for the system testing and maintenance.



**4.2.5.2** After installation, the system shall be functionally tested using smoke generating machines or equivalent as a smoke source. An alarm shall be received at the control unit in not more than 180 s for vehicle decks, and not more than 300 s for container and general cargo holds, after smoke is introduced at the most remote accumulator.

### **4.3 Pre-discharge Alarm of Fixed Gas Fire-Extinguishing System**

**4.3.1** Pre-discharge alarm system, required in 3.6.3, shall give visual and audible warning of the release of fire-extinguishing medium into the protected space.

**4.3.2** The sound alarm shall be audible throughout the protected space at the maximum noise level in the space. The alarm signal shall be easily distinguished from other alarm signals and shall comply with the requirements of the *Code on Alarms and Indicators* – Res. A.1021 (26). The visual signal shall be red in accordance with ISO 2412.

**4.3.3** Conventional cargo spaces, as well as small spaces, such as small compressor rooms, paint lockers, etc. with local fire-extinguishing system need not be provided with pre-discharge alarm system.

**4.3.4** The pre-discharge alarm system shall also comply with the requirements specified in sub-chapter 7.6, *Part VIII – Electrical Installations and Control Systems*.

### **4.4 Fixed Hydrocarbon Gas Detection Systems in Tanker Hull Spaces**

#### **4.4.1 General Requirements**

**4.4.1.1** The system shall comprise a central unit for gas measurement and analysis and gas sampling pipes from 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.

**4.4.1.2** The system may be integrated with the cargo pump-room gas detection system, provided that the spaces, referred to in 4.4.1.1, are sampled at the rate required in 4.4.2.3.1. Continuous sampling from other spaces may also be considered, provided the sampling rate is complied with.

**4.4.1.3** The system shall be designed, constructed and tested in accordance with the guidelines specified in MSC.1/Circ.1370.

## **4.4.2 Component Requirements**

### **4.4.2.1 Gas Sampling Lines**

**4.4.2.1.1** Common sampling lines to the detection equipment shall not be fitted, except the lines serving each pair of sampling points as required in 4.4.2.1.3.

**4.4.2.1.2** The materials of construction and the dimensions of gas sampling lines shall be such as to prevent flow restriction. Where non-metallic materials are used, they shall be electrically conductive. The gas sampling lines shall not be made of aluminium.

**4.4.2.1.3** Configuration of gas sampling lines shall be adapted to the design and size of each space. Except as provided in 4.4.2.1.4 and 4.4.2.1.5, the sampling system shall allow for a minimum of two hydrocarbon gas sampling points, one located on the lower and one on the upper part of the space where sampling is required. Where required, the upper gas sampling point shall not be located lower than 1 m from the tank top. The position of the lower located gas sampling point shall be above the height of the bottom shell-plating girder, however, at least 0.5 m from the bottom of the tank and it shall be provided with means to be closed when clogged. While positioning the fixed sampling points, due regard shall also be paid to the density of vapours of the oil products intended to be transported and the dilution from space purging or ventilation.

**4.4.2.1.4** For ships with deadweight of less than 50,000 tonnes, installation of one sampling location for each tank may be permitted for practical and/or operational reasons.

**4.4.2.1.5** 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.

**4.4.2.1.6** Means shall be provided to prevent gas sampling lines from clogging when tanks are being ballasted by using compressed air flushing to clean the line after switching from ballast to cargo loaded mode. The system shall have an alarm to indicate if the gas sampling lines are clogged.

### **4.4.2.2 Gas Analysis Unit**

**4.4.2.2.1** Gas analysis unit shall 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 fulfilled:

- .1** sampling lines shall not run through gas-safe spaces, except where permitted under .5;
- .2** hydrocarbon gas sampling pipes shall be equipped with flame arresters. Sample hydrocarbon gas shall be led to the atmosphere with outlets

arranged in a safe location, not close to a source of ignition and not close to the accommodation area air intakes;

- .3 manual isolating valve, which shall be easily accessible for operation and maintenance, shall be fitted in each of the sampling lines at the bulkhead on the gas-safe side;
- .4 hydrocarbon gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc., shall be located in a reasonably gas-tight cabinet (e.g. fully enclosed steel cabinet with a door with gaskets) which shall 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 shall be automatically shut down; and
- .5 where the enclosure cannot be arranged directly on the bulkhead, sample pipes shall 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 shall be routed on their shortest ways.

#### **4.4.2.3 Gas Detection Equipment**

**4.4.2.3.1** Gas detection equipment shall be designed to sample and analyse from each sampling line of each protected space, sequentially at intervals not exceeding 30 min.

**4.4.2.3.2** Means shall 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 shall be in place to continue to monitor the atmosphere with portable instruments and to record the measurement results.

**4.4.2.3.3** Audible and visual alarms shall be initiated in the cargo control room, navigation bridge and at the analysing unit when the vapour concentration in a particular space reaches a pre-set value, which shall not be higher than the equivalent of 30% of the lower flammable limit (LFL).

**4.4.2.3.4** Gas detection equipment shall be so designed that it may be readily tested and calibrated.

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## **5 FIRE-FIGHTING EQUIPMENT, ESCAPE EQUIPMENT, SPARES AND TOOLS**

### **5.1 Fire-Fighting Equipment and Escape Equipment**

#### **5.1.1 General Requirements**

**5.1.1.1** Fire-fighting equipment and escape equipment (hereinafter referred to as equipment) shall comply with the requirements specified in the *Rules for Statutory Survey of Sea-going Ships, Part VIII – Fire-fighting Equipment and Escape Equipment*.

**5.1.1.2** Equipment shall be located in easily accessible and visible places on the ship and shall be fixed to bulkheads/linings/decks in a safe manner, allowing its immediate use.

**5.1.1.3** The location, on board the ship, of each equipment specified in the present Chapter shall be indicated by a plate with the symbol used on *Fire Control Plan*. The plates shall be made of photoluminescent material complying with the requirements specified in Res. A.760(18) or from other material and marked by lighting supplied from the emergency source of power.

Additionally, such plates shall be used to mark the following components of the fire-fighting appliances: manually operated call points, general alarm call points, control panel, emergency sources of electric power (aggregate, accumulator batteries), emergency switchboard, fire pumps, tanks/cylinders of gas fire-extinguishing systems, air compressor for breathing apparatus, controls for: remote operation of fixed fire-extinguishing systems, remote stopping of fuel and lubricating oil pumps, remote operation of fire pumps, remote operation of bilge pumps, closing of oil fuel/oil tank valves, remote stopping of fans and fire dampers in ventilation ducts, remote closing of fire dampers, closing appliances for ventilation openings in the spaces, as well as section valves and shut-off valves of water and foam fire-extinguishing systems, fire hydrants and fire hose boxes, as specified in particular paragraphs of the present Part of the *Rules*.

**5.1.1.4** The equipment shall be kept in good working condition and be available for immediate use at all times whether at sea or in port and shall be used exclusively for fire fighting, rescue operations and training purposes.

**5.1.1.5** Spare equipment shall be stored in the fire-fighting equipment locker or in other space specially designed for this purpose. It is recommended that there should be two fire-fighting equipment lockers on the ship, one of them being located within superstructure.

Each fire-fighting equipment locker shall be indicated, at access door, by a plate with the symbol used on *Fire Control Plan*.

**5.1.1.6** Suitable space/stand for overhauling and maintenance of stored equipment to ensure its readiness for immediate use shall be provided in the fire-fighting equipment room.

**5.1.1.7** A set consisting of crowbar and fire axe shall be located inside accommodation spaces area, near exits.

**5.1.1.8** Fire protection warning plates with inscriptions: DANGER and NO SMOKING, written in English and in the working language of the ship shall be provided on board. The plates of dimensions not less than 840 x 600 mm shall be white with 20 mm borders. The letters shall be black and at least 120 mm in height.

**5.1.1.9** Fire equipment protecting against the effect of fire, such as fire blankets, protective clothing and gloves shall be supplied with asbestos free declaration.

## **5.1.2 Portable and Mobile Fire-Extinguishers**

**5.1.2.1** Powder or carbon dioxide portable fire-extinguishers shall have a capacity of at least 5 kg; foam fire-extinguishers – a capacity of at least 9 l each. The total mass of a portable fire-extinguisher shall not exceed 20 kg.

In spaces of small volumetric capacity, carbon dioxide portable fire-extinguishers having a capacity less than 5 kg shall be applied, see 5.1.2.9.

Fire-extinguishers shall be of approved type, based on the guidelines specified in Res. A.951(23).

Only refills approved for the fire-extinguisher in question shall be used for recharging.

**5.1.2.2** Fire-extinguishers with fire-extinguishing capability equivalent to that of 9 l foam fire-extinguisher may be considered as equivalent.

**5.1.2.3** While selecting fire-extinguishers for particular spaces, a risk of the specific group of fire shall be taken into account (see the definition of group of fires A, B, C, D, F or K given in 1.2.17). Fire-extinguishers shall be used as follows:

- .1** accommodation spaces – group A;
- .2** service spaces:
  - drying rooms, pantries containing cooking appliances – group A or B;
  - lockers of 4 m<sup>2</sup> deck area or above (mail and luggage rooms) – group B;
  - galleys – group B, additionally group F or K;
- .3** control stations – group A, with additional extinguishing medium for electrical equipment fires;
- .4** machinery spaces and cargo pump-rooms – group B, with additional extinguishing medium for electrical equipment fires;
- .5** workshops – group A or B;
- .6** ro-ro spaces, vehicle spaces and special category spaces - group B;
- .7** cargo spaces – groups A, B, C or D, depending on the carried cargoes;

- .8 open decks – group B;
- .9 helideck – group B.

**5.1.2.4** Fire-extinguishers containing an extinguishing medium which either by itself or under expected conditions of use gives off toxic gases in such quantities as to endanger persons or gives off gases which are harmful to the environment are not permitted.

**5.1.2.5** Portable fire-extinguishers shall be provided with devices or lead-sealed safety pin to indicate whether they have been used.

**5.1.2.6** Portable fire-extinguishers shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of fire, and in such a way that their serviceability is not impaired by weather, vibration or other external factors.

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

It is recommended that the remaining portable fire-extinguishers in the public spaces and workshops be located at or near the main entrances and exits.

**5.1.2.7** In accommodation and service spaces, in machinery spaces of category A and galleys, the minimum number of portable fire-extinguishers and their location shall be such that no point in the space is more than 10 m walking distance from an extinguisher.

**5.1.2.8** CO<sub>2</sub> fire-extinguishers shall not be placed in accommodation spaces or in explosion threatened spaces.

**5.1.2.9** In control stations and other spaces containing electrical or electronic equipment or appliances necessary for the safety of the ship, portable fire-extinguishers shall be provided whose extinguishing media are neither electrically conductive nor harmful to the equipment and appliances.

Where portable CO<sub>2</sub> fire-extinguishers are provided, the volume of any space containing one or more extinguishers shall be such as to avoid the health risk, i.e. limit the volumetric concentration of vapour that can occur due to the discharge to not more than 5%. The volume of CO<sub>2</sub> (at 100% concentration) shall be calculated at 0.56 m<sup>3</sup>/kg. For instance, a portable CO<sub>2</sub> fire-extinguisher of 5 kg capacity may be applied in a space of net volumetric capacity more than 56 m<sup>3</sup>.

**5.1.2.10** The requirements concerning the arrangement of fire-extinguishers in ship spaces are specified in the relevant provisions of *Part V* concerning particular spaces; these requirements are listed in Table 5.1.6-1 and Table 5.1.6-2.

**5.1.2.11** Mobile fire-extinguisher is a wheeled extinguisher with at least 20 kg extinguishing media capacity, provided with an actuating device containing propellant gas which allows immediate and independent fire-extinguishing operation.

In ships of less than 500 gross tonnage, mobile fire-extinguishers may be – subject to PRS' approval – used as an alternative fire arrangement for fire-extinguishing equipment required in particular chapters of *Part V*.

#### **5.1.2.12 Spare Charges**

In cargo ships of 150 gross tonnage and upwards and in passenger ships, spare charges shall be provided for 100% of the first 10 extinguishers and 50% of the remaining fire-extinguishers capable of being recharged on board. However, not more than 60 total spare charges are required.

For fire-extinguishers which cannot be recharged on board, an additional portable fire-extinguishers of the same quantity, type, capacity and number shall be provided instead of spare charges.

Spare charges shall be stored in the fire-fighting equipment locker or in other designated space.

#### **5.1.3 Portable Foam Applicator Unit**

**5.1.3.1** Portable foam applicator unit shall consist of a foam nozzle/branch pipe, either of a self-inducing type or in combination with a separate inductor, capable of being connected to the fire main by a fire hose, a portable tank containing at least 20 l of foam concentrate and at least one foam concentrate spare tank of the same capacity.

**5.1.3.2** The nozzle/branch pipe and inductor shall be capable of producing effective foam suitable for extinguishing an oil fire, at a foam solution rate of at least 200 l/min at the nominal pressure fire main.

**5.1.3.3** Portable foam applicator unit shall be so designed as to withstand clogging, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered on ships.

**5.1.3.4** Foam concentrate shall be of an approved type. Foam concentrate is subject to type approval tests to be performed in accordance with the guidelines specified in MSC.1/Circ.1312/Corr.1.

**5.1.3.5** The values of the foam expansion and drainage time of the foam produced by the portable foam applicator unit shall not differ by more than  $\pm 10\%$  of those determined in the circular, referred to above.

#### **5.1.4 Fire-Fighter's Outfit**

**5.1.4.1** Ships of 500 gross tonnage and upwards engaged on international voyages shall carry at least two fire-fighter's outfits.

Cargo ships of 150 gross tonnage and upwards shall carry at least one fire-fighter's outfit, see 6.21.6.2.

**5.1.4.2** Fire-fighter's outfit shall consist of the following:

- .1** personal equipment, comprising:
  - .1** protective clothing made of material protecting the skin from the heat, radiating from the fire and from burns and scalding by flame or steam. The outer surface of the protective clothing shall be water-resistant;
  - .2** fire fighter's gloves;
  - .3** fire fighter's boots;
  - .4** fire-fighter's helmet;
  - .5** electric safety lamp of approved type, with a minimum burning period of 3 h. Electric safety lamps used on tankers, as well as on other ships in hazardous areas shall be of an explosion-proof type, in accordance with Publication IEC 60079;
  - .6** fireman's belt with snap fastener and fireman's axe in a sheath. The handle of the axe shall be provided with high-voltage insulation;
- .2** breathing apparatus, which shall be a self-contained compressed-air-operated breathing apparatus, the volume of air in the cylinders being at least 1200 l or other self-contained breathing apparatus capable of functioning for at least 30 min. The breathing apparatus shall be fitted with an audible and visual alarm 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 l. All air cylinders shall be fitted with coupling of the same type to make them interchangeable.

**5.1.4.3** Two spare charges shall be provided for each required breathing apparatus. Ships equipped with suitably located means/compressors for fully recharging the air cylinders free from contamination (fitted with filters preventing contamination) need to carry only one spare charge for each breathing apparatus.

Means/compressors for recharging the air cylinder, as well as spare charges for breathing apparatus shall be kept in the space in which breathing apparatus are located.

The location of means/compressor for recharging the air cylinders shall be indicated by a plate with the symbol used on *Fire Control Plan*.

**5.1.4.4** For each breathing apparatus, a fireproof lifeline at least 30 m in length shall be provided. The lifeline shall be subjected to a strength test by static load of 3.5 kN for 5 min. The lifeline shall be capable of being attached by means of snaphook to the harness of the apparatus or to a separate belt in order to prevent the breathing apparatus from becoming detached when the lifeline is operated.

**5.1.4.5** Fire-fighter's outfits and sets of personal equipment shall be kept ready for use in an easily accessible location that is permanently and clearly marked.



Where more than one fire-fighter's outfit or more than one set of personal equipment are carried, they shall be stored in widely separated positions.

One set of fire-fighter's outfit shall be available on the navigation bridge or in its vicinity.

### **5.1.5 Emergency Escape Breathing Devices**

**5.1.5.1** Emergency escape breathing device is a supplied air or oxygen device only used for escape from a compartment that has a hazardous atmosphere, dangerous to life and health.

The emergency escape breathing device shall not be used for fighting fires, entering oxygen deficient spaces or tanks or worn by fire-fighters.

**5.1.5.2** Emergency escape breathing device shall consist of a full face piece or a hood and oxygen or air cylinder.

**5.1.5.3** Full face piece shall form a complete seal around the eyes, nose and mouth.

**5.1.5.4** Hood shall completely cover the head, neck and may cover portions of the shoulders.

**5.1.5.5** Hood and a full face piece shall be made of flame-resistant materials and include a clear window for viewing.

**5.1.5.6** Emergency escape breathing device shall have a service duration of at least 10 min.

**5.1.5.7** Emergency escape breathing device shall be capable of being carried hands-free. When stored, the device shall be suitably protected from the environment.

**5.1.5.8** Emergency escape breathing devices shall be manufactured and marked in accordance with the requirements stated in Chapter 2 of the *FSS Code* and the guidelines specified in *MSC/Circ.849*.

**5.1.5.9** In all ships of 500 gross tonnage and upwards engaged on international voyages, there shall be carried at least two emergency escape breathing devices on escape routes within accommodation spaces (see 2.3.2.7), at least two emergency escape breathing devices in machinery spaces of category A (see 2.3.2.4), at least two spare devices and, for the purposes of drills, at least one emergency escape breathing device located in a fire-fighting equipment locker.

For the arrangement of emergency escape breathing devices in passenger ships, see 6.1.6.12.

## 5.1.6 Ship Fire-Fighting Equipment and Emergency Escape Equipment

**5.1.6.1** The list of requirements for fire-fighting equipment and emergency escape equipment on ships of 500 gross tonnage and upwards is given in Table 5.1.6-1.

**5.1.6.2** The list of minimum requirements for fire-fighting equipment and emergency escape equipment on ships of less than 500 gross tonnage is given in Table 5.1.6-2. The equipment arrangement shall be in accordance with the requirements given in Table 5.1.6-1.

**Table 5.1.6-1**  
**Fire-fighting equipment for ships of 500 gross tonnage and upwards**

Item	Equipment	Number and arrangement
1	2	3
1	Fire hoses complete with fittings in accordance with the requirements specified in 3.2.7: 1. for the water fire main system	a) equal to the number of the ship's hydrant valves; b) for ships carrying dangerous goods, additionally 3 items; c) on helideck, additionally 2 items.
	2. for the foam fire-extinguishing system	a) equal to the number of the ship's hydrants intended for foam supplying. Water hoses mentioned in 1.1, may be included in this number, provided that their diameter is adequate for foam supply.
2	Fire hose nozzles: 1. water dual-purpose type, producing solid and dispersed water jet	– equal to the number of the ship's hydrant valves.
	2. water fog applicators with extensions	a) for passenger ships carrying more than 36 passengers: – in each machinery space of category A – 3 items; – for each 2 breathing apparatus – 1 item; – in each special category space – 3 items; b) in each ro-ro cargo space – 3 items.
3	Portable foam applicator complying with the requirements specified in 5.1.3 with a spare foam concentrate container	a) in machinery spaces containing oil-fired boilers – 1 set; b) in machinery spaces containing internal combustion engines – 1 set; c) in special category spaces – 1 set, not fewer, however, than 2 sets for a ship, d) in ro-ro cargo spaces – 1 set, not fewer, however, than 2 sets for a ship.

1	2	3
4	<p>Mobile fire-extinguisher:</p> <ul style="list-style-type: none"> <li>– 135 l or equivalent foam unit</li> <li>– 45 l or equivalent foam unit</li> <li>– 50 kg or equivalent dry powder unit</li> <li>– 45 kg or equivalent carbon dioxide unit</li> </ul>	<p>a) in machinery spaces containing oil fired boilers or oil fuel units</p> <ul style="list-style-type: none"> <li>– one 135 l foam unit or equivalent dry powder unit with reeled hose;</li> </ul> <p>b) in machinery spaces containing internal combustion engines – one 45 l foam unit or equivalent dry powder unit.</p> <p>The unit is not required where the machinery space is fitted with a local carbon dioxide extinguishing system with hose and nozzle;</p> <p>c) in machinery spaces containing steam turbines or shielded steam turbines:</p> <ul style="list-style-type: none"> <li>– 45 l foam units or equivalent dry powder units in the number sufficient to supply extinguishing medium to each piece of equipment or fire-threatened area.</li> </ul> <p>The units are not required where the machinery space is fitted with a fixed fire extinguishing system;</p> <p>d) in machinery space with main electric propulsion motors – one 50 kg dry powder unit or one 45 kg carbon dioxide unit;</p> <p>e) helideck – two 50 kg dry powder units,</p> <p>f) on crude oil carriers in rooms containing crude oil-fired boilers or cargo slop fired boilers:</p> <ul style="list-style-type: none"> <li>– one 135 l foam unit or one equivalent dry powder unit.</li> </ul> <p>The units are not required where the machinery space is fitted with the foam fire-extinguishing system, including fixed generators of foam, ensuring supply of foam to front walls of boilers and to drip trays under the burners.</p>
5	<p>9 l foam fire-extinguishers or equivalent fire-extinguishers</p>	<p>a) accommodation and service spaces:</p> <ul style="list-style-type: none"> <li>– in corridors – the distance to a fire-extinguisher shall not exceed 25 m on each deck and in each main vertical zone;</li> <li>– one fire-extinguisher per each space of the total surface area not exceeding 250 m<sup>2</sup> or in the other part of deck containing public spaces;</li> <li>– one fire-extinguisher in the sick-bay;</li> <li>– one fire-extinguisher in the drying room and in the pantry containing cooking appliances;</li> </ul> <p>b) control stations:</p> <ul style="list-style-type: none"> <li>– two fire-extinguishers in the wheelhouse of the total surface area 50 m<sup>2</sup> or more;</li> <li>– one fire-extinguisher in the wheelhouse of the total surface area less than 50 m<sup>2</sup>;</li> <li>– one fire-extinguisher in a control station other than the wheelhouse;</li> </ul>

1	2	3
		<ul style="list-style-type: none"> <li>– one fire-extinguisher on the navigation bridge;</li> <li>– one fire-extinguisher in the emergency generator space;</li> <li>– one fire-extinguisher in the space of emergency fire pump driven by internal combustion engine;</li> <li>c) machinery spaces containing oil fuel-fired boilers: <ul style="list-style-type: none"> <li>– two fire-extinguishers in way of furnaces and in each space containing oil fuel lines, and additionally one fire-extinguisher per each furnace instead of the sand container;</li> </ul> </li> <li>d) machinery spaces with internal combustion engines: <ul style="list-style-type: none"> <li>– one fire-extinguisher at each level of engine room at port and starboard side and additional extinguishers so positioned that the distance to the fire-extinguisher does not exceed 10 m and two foam fire-extinguishers are required at the floor level;</li> </ul> </li> <li>e) machinery spaces with turbines or shielded steam engines: <ul style="list-style-type: none"> <li>– one fire-extinguisher at each level of engine room at port and starboard side and additional extinguishers so positioned that the distance to the fire-extinguisher does not exceed 10 m and two foam fire-extinguishers are required at the floor level;</li> </ul> </li> <li>f) spaces containing oil fuel firing inert gas generators: <ul style="list-style-type: none"> <li>– two fire-extinguishers;</li> </ul> </li> <li>g) spaces containing oil fuel centrifuge: <ul style="list-style-type: none"> <li>– one fire extinguisher;</li> </ul> </li> <li>h) incinerating plant spaces: <ul style="list-style-type: none"> <li>– one fire-extinguisher;</li> </ul> </li> <li>i) cargo pump-rooms in oil tankers, fuel and liquid cargo stations, as well as storage spaces of hoses for flammable liquids: <ul style="list-style-type: none"> <li>– two fire-extinguishers in the cargo pump room;</li> <li>– one fire-extinguisher per each 30 m<sup>2</sup> of space floor area;</li> </ul> </li> <li>k) processing spaces: <ul style="list-style-type: none"> <li>– one fire-extinguisher per each processing space or per each 250 m<sup>2</sup> of such space;</li> </ul> </li> <li>l) store-rooms of flammable paints and liquids: <ul style="list-style-type: none"> <li>– one fire-extinguisher;</li> </ul> </li> <li>m) workshops: <ul style="list-style-type: none"> <li>– one fire-extinguisher;</li> </ul> </li> <li>n) steering gear space: <ul style="list-style-type: none"> <li>– one fire-extinguisher;</li> </ul> </li> <li>o) special category spaces and ro-ro cargo spaces:</li> </ul>

1	2	3
		<ul style="list-style-type: none"> <li>– fire-extinguishers at each side spaced by 20 m from each other;</li> <li>p) open deck on tankers:               <ul style="list-style-type: none"> <li>– two fire-extinguishers;</li> </ul> </li> <li>q) open deck, open ro-ro spaces or open vehicle spaces – suitable number of fire-extinguishers</li> </ul>
6	Fire-extinguishers for fighting group F or K fires (burning edible oil)	Ships having galleys fitted with deep-fat cooking appliances: <ul style="list-style-type: none"> <li>– one fire-extinguisher in way of deep-fat cooking appliance.</li> </ul>
7	12 kg dry powder fire-extinguishers	<ul style="list-style-type: none"> <li>a) ro-ro cargo spaces:               <ul style="list-style-type: none"> <li>– one fire-extinguisher at each side of each deck spaced by 20 m from each other;</li> </ul> </li> <li>b) cargo spaces for the carriage of dangerous cargoes:               <ul style="list-style-type: none"> <li>– one or two fire-extinguishers of the total content of 12 kg of dry powder.</li> </ul> </li> </ul>
8	5 kg carbon dioxide fire-extinguishers or equivalent fire-extinguishers, intended for extinction of fire in equipment under voltage	<ul style="list-style-type: none"> <li>a) machinery spaces with main internal combustion engines:               <ul style="list-style-type: none"> <li>– one fire-extinguisher for engine rooms with engines of the total output less than 750 kW;</li> <li>– two fire-extinguishers for engine rooms with engines of the total output of 750 kW and over;</li> <li>– two fire-extinguishers in way of each main distribution board;</li> </ul> </li> <li>b) machinery spaces with main propulsion electric motors:               <ul style="list-style-type: none"> <li>– two fire-extinguishers per each motor;</li> </ul> </li> <li>c) machinery spaces with auxiliary power generating sets:               <ul style="list-style-type: none"> <li>– one fire-extinguisher at each free standing unit or per each two units installed side-by-side;</li> </ul> </li> <li>d) ECR:               <ul style="list-style-type: none"> <li>– one fire-extinguisher and additionally one fire-extinguisher if the main distribution board is located in the ECR;</li> </ul> </li> <li>e) machinery spaces with electric motors:               <ul style="list-style-type: none"> <li>– one fire-extinguisher for spaces of floor area less than 30 m<sup>2</sup>;</li> <li>– two fire-extinguishers for spaces of floor area exceeding 30 m<sup>2</sup>;</li> </ul> </li> <li>f) switchboard space in the area of accommodation spaces:               <ul style="list-style-type: none"> <li>– one fire extinguisher in the adjacent corridor;</li> </ul> </li> <li>g) contactor spaces:               <ul style="list-style-type: none"> <li>– one fire extinguisher in each space;</li> </ul> </li> <li>h) refrigerating plant spaces, spaces of air-conditioning units and fans where electric equipment is installed:</li> </ul>

1	2	3
		<ul style="list-style-type: none"> <li>– one fire-extinguisher for spaces of floor space less than 30 m<sup>2</sup>;</li> <li>i) steering gear and thruster spaces:               <ul style="list-style-type: none"> <li>– one fire-extinguisher in each space;</li> </ul> </li> </ul>
		<ul style="list-style-type: none"> <li>j) navigation bridge, radio stations and chartrooms:               <ul style="list-style-type: none"> <li>– one fire-extinguisher in each space or in corridor near the entrance;</li> </ul> </li> <li>k) gyrocompass space:               <ul style="list-style-type: none"> <li>– one fire-extinguisher in each space;</li> </ul> </li> <li>l) sick-bay, telephone exchange:               <ul style="list-style-type: none"> <li>– one fire-extinguisher in each space;</li> </ul> </li> <li>m) galley:               <ul style="list-style-type: none"> <li>– one fire-extinguisher in each space;</li> </ul> </li> <li>n) helideck               <ul style="list-style-type: none"> <li>– four fire-extinguishers;</li> </ul> </li> <li>o) helicopter hangar:               <ul style="list-style-type: none"> <li>– one fire-extinguisher.</li> </ul> </li> <li>p) in the proximity of electric panels:               <ul style="list-style-type: none"> <li>– one fire-extinguisher for every panel having a power of 20 KW or more.</li> </ul> </li> </ul>
9	Fire-fighter's outfit complying with the requirements specified in 5.1.4	<ul style="list-style-type: none"> <li>a) all ships:               <ul style="list-style-type: none"> <li>– two sets;</li> </ul> </li> <li>b) oil tankers:               <ul style="list-style-type: none"> <li>– additionally two sets;</li> </ul> </li> <li>c) all passenger ships:               <ul style="list-style-type: none"> <li>– additionally, two sets of fire-fighter's outfit and two sets of personal equipment per each 80 m of length of accommodation and service spaces on the deck with greatest total length of such spaces;</li> </ul> </li> <li>d) passenger ships carrying more than 36 passengers:               <ul style="list-style-type: none"> <li>– additionally, two sets per each main vertical zone;</li> </ul> </li> <li>e) ships with helideck:               <ul style="list-style-type: none"> <li>– additionally two sets;</li> </ul> </li> <li>f) ships carrying dangerous goods:               <ul style="list-style-type: none"> <li>– additionally two breathing apparatus.</li> </ul> </li> </ul>
10	Fire blanket	<ul style="list-style-type: none"> <li>a) navigation bridge – 1 item;</li> <li>b) machinery spaces with engines of the total output:               <ul style="list-style-type: none"> <li>– less than 400 kW – 1 item;</li> <li>– 401 ÷ 800 kW – 2 items;</li> <li>– more than 800 kW – 3 items;</li> </ul> </li> <li>c) helideck – 1 item;</li> <li>d) a separate oil-fired boiler-room – 1 item;</li> <li>e) each motor rescue boat – 1 item.</li> </ul>
11	Crowbar and fire axe	1 set – at each accommodation spaces deck.

1	2	3
12	Portable international shore connection for the supply of water to the water fire main system	1 item – required for all ships of gross tonnage 500 and more engaged on international voyages.
13	Portable exhaust fan	one set – for gas removal from a space protected by fixed carbon dioxide system, for ships without mechanical ventilation in protected spaces
14	Portable instrument for measuring concentration of flammable vapours, together with a set of spare parts and calibration instrument.  Portable instrument for measuring concentration of oxygen	2 items – in tankers carrying cargoes with ignition temperature not exceeding 60°C.  2 items – in tankers carrying cargoes with ignition temperature not exceeding 60°C.
15	Exhaust gas analyser	1 instrument – for ships intended for the carriage of mechanical vehicles with fuel in their tanks.
16	Light fire hook	1 item – at helideck.
17	Salvage set, see paragraph 7.1.2.6	1 set – at helideck.
18	Carbon dioxide detector	For ships fitted with fixed carbon dioxide fire-extinguishing systems: 1 carbon dioxide detector or portable carbon dioxide analyser; 10 tube-type carbon dioxide detectors. CO <sub>2</sub> detector is not required on ships provided with portable instrument for measuring concentration of oxygen.
19	Fire protection information board	2 boards per ship.
20	Chemicals resisting clothing	For ships carrying dangerous goods – 4 sets.
21	Emergency escape breathing device in accordance with the requirements of 5.1.5	a) all cargo ships of gross tonnage 500 and more engaged on international voyages – accommodation spaces: – 2 items located along escape routes; – 1 item – spare device and 1 item – intended for drills, stored in fire-fighting equipment room; b) all ships of gross tonnage 500 and more, and all passenger ships engaged on international voyages – machinery spaces of category A: – 2 items located along escape routes, additionally 1 item at each level of platform or deck; – additionally 1 item in ECR, if ECR is a separate space. – additionally 1 item in way of workshops being separate spaces. c) passenger ships – accommodation spaces: – 2 items in each main vertical zone; – 1 item – spare device and 1 item – intended for drills, stored in fire-fighting equipment room; d) passenger ships carrying more than 36 passengers: – additionally 2 items in each main vertical zone.

**Table 5.1.6-2**  
**Fire-fighting equipment for ships less than 500 <sup>1)</sup> gross tonnage**

Item	Watercraft type	9 / foam fire extinguisher or equivalent	Carbon dioxide fire extinguisher	45 / mobile foam fire extinguisher	Fire hose, dual-purpose nozzle	Fire blanket	Fire-fighter's outfit	Fire-fighter's axe and crowbar	Fire gloves
1	2	3	4	5	6	7	8	9	10
1	Cargo ship	5	5	–	Number equal to the number of hydrants installed on shipboard	2	1 <sup>2)</sup>	1	1
2	Rescue ship, research vessel, surveying vessel	5	3	–		2	–	1	1
3	Dredger	5	5	–		2	–	1	1
4	Pilot cutter, research inspector, surveying vessel, tug with main propulsion rating less than 368 kW	5	3	–		1	–	1	1
5	Tug and fire-fighting ship with main propulsion rating from 368 kW to 769 kW	5	3	1		2	1 <sup>2)</sup>	1	1
6	Fishing vessel	5	3	–		2	–	1	1
7	Non-propelled barge	1	1	–		+	–	–	1
8	Propelled barge	3	2	–		1	–	1	1
9	Diver's non-propelled barge, floating workshop	2	1	–		1	–	1	1
10	Non-propelled hopper barge	2	1	–		1	–	–	–
11	Propelled hopper barge, floating crane	4	3	–		2	–	1	1
12	House boat	3	1	–		1	–	1	1

<sup>1)</sup> Unless expressly provided otherwise by the flag State Administration.

<sup>2)</sup> Applies to ships of 150 gross tonnage and upwards.

## 5.2 Spare Parts and Tools

### 5.2.1 General Requirements

**5.2.1.1** Spares and tools for fire-extinguishing systems shall be kept in a fire-fighting equipment locker or other space provided for this purpose, e.g. fire-extinguishing station.



**5.2.1.2** In spaces where fire-extinguishing systems pumps, compressors and motors are installed, a place for keeping the spares and tools intended for maintenance of the systems shall be provided.

**5.2.1.3** Spare parts shall be properly marked.

## 5.2.2 Recommended Numbers of Spares and Tools

Spare parts for fixed fire-extinguishing systems and tools for assembly shall be stored on board. The recommended numbers of spares and tools are specified in Table 5.2.2, recommendations of the systems components manufacturers shall also be taken into account.

**Table 5.2.2**  
**Required number of spares and tools**

Item	Name of spare part or tool	Number required per ship
1	2	3
1	Water fire main system: 1. fire hoses of each length and diameter used aboard the ship, fitted complete with couplings and hose nozzle; 2. reducers with couplings for each size fitted (if the ship is provided with hydrants of various diameters); 3. hose couplings – for ships of less than 4000 gross tonnage; 4. hose couplings – for ships of 4000 gross tonnage and upwards; 5. rubber joints for couplings, hose nozzles, etc.; 6. hose clamps; 7. wrenches for hose couplings; 8. complete fire hydrant valves of each size fitted.	– for ships of 1000 gross tonnage and upwards – 5 items; – for ships of less than 1000 gross tonnage – 3 items 2 items 2 items (for each diameter) 4 items (for each diameter) 5% of the total number, however no fewer than 10 items 4 items (for ships of less than 300 gross tonnage – 2 items) 2 items 2 items per each size
2	Automatic sprinkler system: 1. sprinkler heads, complete; 2. wrenches for sprinkler heads (where heads are fitted by means of special wrenches); 3. parts for section valve.	total number of heads: < 300                    6 300 ÷ 1000            12 > 1000                 24 1 item per section 1 set, in accordance with delivery specification
3	Water-spraying system and water-based system : 1. spraying nozzles used in the system; 2. wrenches for spraying nozzles.	5% of the total number of spraying nozzles fitted 1 item

1	2	3
4	Foam fire-extinguishing system: 1. hydrant valves of each type and size fitted; 2. air-foam nozzle; 3. isolating diaphragms; 4. disks for inserting diaphragms; 5. dosing device diaphragm	1 item  1 item 200% of the number of diaphragms fitted 10% of the total number of those fitted, no fewer, however, than 2 items 1 item.
5	Carbon dioxide system: 1. adjustable spanner; 2. plugs for pipes leading from cylinder valves to manifolds; 3. thrust bushes and nuts for protective devices; 4. protective caps for cylinders; 5. non-return valves;  6. discharge nozzles of each type and size fitted.	1 item 25% of the number of cylinders  10% of the number of cylinders  100% of the number of cylinders 5% of the number of cylinders, no fewer, however, than 1 item 2 items
6	Inert gas system: 1. control valve (sluice valve) for admitting gas into spaces protected; 2. parts for automatic control.	1 item  in accordance with delivery specification
7	Dry powder system: 1. parts of nozzles and monitors means of control; 2. nozzles of each type and size fitted; 3. special wrenches for the assembly of valves, nozzles, monitors, spraying nozzles.	1 set per each part  1÷2 items 1 set
8	Other gas fire-extinguishing systems: 1. plugs for pipes leading from cylinder valves to manifolds; 2. thrust bushes and nuts for protective devices; 3. protective caps for cylinders, 4. non-return valves;  5. O-rings; 6. discharge nozzles of each type and size fitted; 7. pressure-reducing valves (or orifice plates), for the number of items installed: – less than 50 items – 51 ÷ 100 items – above 100 items	25% of the number of cylinders  10% of the number of cylinders  100% of the number of cylinders 5% of the number of cylinders, no fewer, however, than 1 item 1 set 2 items.  1 item 2 items 3 items

1	2	3
	8. Pressure gauges, for the number of cylinders installed: – less than 50 items – 51 ÷ 100 items – above 100 items	1 items 2 items 3 items
9	General requirements for all systems: 1. instruments and gauges, such as pressure gauges and thermometers of each type fitted in the systems; 2. sufficient quantity of packing material for onboard repairs; 3. fuses for automatic closing fire doors and dampers; 4. spares for pumps, fans, compressors and motors serving fire-extinguishing systems; 5. spare parts and tools for remote control equipment of fire-extinguishing systems; 6. spare parts and tools for fire alarm systems; 7. flame arresters (inserts) of each type and size; 8. spare parts for electrical equipment of fire-extinguishing systems.	1 item of each type  1 set  100% of automatic fire doors and dampers closing upon activation of the fuses in accordance with the requirements specified in Annex to <i>Part VI – Machinery Installations and Refrigerating Plants</i> in accordance with technical specification approved by PRS in each particular case in accordance with technical specification approved by PRS in each particular case 1÷2 sets  in accordance with the requirements specified in Chapter 23 of <i>Part VIII – Electrical Installations and Control Systems</i>
10	Fire detection and fire alarm system: – fire detectors.	5% of the total of each type of fire detectors used (no fewer, however, than 2 items).

## 6 ADDITIONAL REQUIREMENTS

The requirements specified in Chapter 6 apply to ships which are to be assigned additional marks in the symbol of class. These requirements shall be considered as supplementary to those specified in Chapters 1, 2, 3, 4, 5 and 7 which constitute the basic requirements for all types of ships.

### 6.1 Passenger Ships – Mark: PASSENGER SHIP

The requirements specified in sub-chapter 6.1 apply to all passenger ships, as well as to those ships engaged on domestic voyages for which additional mark **Class A, Class B, Class C or Class D** in the symbol of class is requested to be affixed, unless stated otherwise in sub-chapter 6.20 (for class definition, see *Part I – Classification Regulations*).

#### 6.1.1 Ship Construction

##### 6.1.1.1 General Requirements

**6.1.1.1.1** The construction of ceilings and linings shall be such as to make it possible, without impairing the efficiency of the fire protection, for the fire patrols to detect any smoke originating in concealed and inaccessible places, except where there is no risk of fire originating in such places. To comply with this requirement, open-work linings or inspection hatches may be used.

**6.1.1.1.2** The construction of light weight fire divisions (honeycomb type) made of steel may be used as non load-bearing internal A Class divisions in accommodation and services spaces, provided they have successfully passed the relevant standard fire test according to the *FTP Code*, Annex 1, Part 3. These constructions shall not be used as an integral part of main fire zone bulkheads and stairway enclosures.

**6.1.1.1.3** On passenger ships with cabin balconies of the accommodation spaces, non-load bearing partial bulkheads which separate adjacent balconies shall be capable of being opened by the crew from each side for the purpose of fighting fires.

##### 6.1.1.2 Materials for Room Furnishing

###### 6.1.1.2.1 Divisions<sup>1</sup>, Ceilings and Linings

All linings, grounds, draught stops and ceilings shall be of non-combustible materials except in cargo spaces, mail rooms, baggage rooms, saunas or refrigerated compartments of service spaces.

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<sup>1)</sup> Interpretations regarding the use of materials for the construction of bulkheads in accommodation spaces on passenger ships are given in MSC/Circ.1120 for *SOLAS* regulations II-2/5.3 and II-2/6.2.

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

On passenger ships with cabin balconies of the accommodation spaces, linings, ceilings and partial bulkheads or decks used to screen or to separate adjacent cabin balconies shall be of non-combustible materials.

#### **6.1.1.2.2 Use of Combustible Materials**

A, B or C Class divisions in accommodation and service spaces which are faced with combustible materials, facings, mouldings, decorations and veneers shall fulfil the requirements specified in 2.1.2.2.2 to 2.1.2.2.6 and in 6.1.1.2.3. Traditional wooden benches and wooden linings on bulkheads and ceilings, however, are permitted in saunas and such materials need not be subject to the calculations of the gross calorific value and total volume of the combustible materials required in 2.1.2.2.2 and 2.1.2.2.3.

Materials used for facing of balconies in the accommodation spaces need not be subject to the calculations of the total volume of the combustible materials required in 2.1.2.2.3.

#### **6.1.1.2.3 Materials for Exposed Surfaces**

Materials used for facing the exposed surfaces, specified in 2.1.2.2.4, shall have low flame-spread characteristics. Exposed surfaces in corridors and stairway enclosures and of bulkhead and ceiling linings in accommodation and service spaces (except saunas), as well as control stations shall also have low flame-spread characteristics.

On passenger ships with cabin balconies of the accommodation spaces, exposed surfaces of cabin balconies, except for natural hard wood decking systems shall have low flame-spread characteristics.

#### **6.1.1.2.4 Maximum Total Mass of Combustible Materials in Accommodation Spaces**

For ships carrying not more than 36 passengers, it is recommended, in accordance with the guidelines specified in MSC/Circ.1003, that the total mass of combustible materials per unit area in the space should not exceed the values required for cargo ships, as set forth in 2.1.2.2.7.

For ships carrying more than 36 passengers, it is recommended that the total mass of combustible materials per unit area in the space should not exceed the following values:

- 5 kg/m<sup>2</sup> – for corridors, stairways and control stations;
- 15 kg/m<sup>2</sup> – for accommodation spaces of low fire risk;
- 35 kg/m<sup>2</sup> – for accommodation spaces of moderate and high fire risk;
- 45 kg/m<sup>2</sup> – for service spaces bounded by A Class divisions.

### **6.1.1.2.5 Paints, Varnishes and Other Finishes**

On passenger ships with cabin balconies of the accommodation spaces, paints, varnishes and other finishes used on exposed interior surfaces shall not be capable of producing excessive quantities of smoke and toxic products, this being confirmed in accordance with the *Fire Test Procedure Code*, Annex 1, Part 2.

### **6.1.1.2.6 Primary Deck Coverings**

On passenger ships with cabin balconies of the accommodation spaces, primary deck coverings shall be made of the approved material which will not readily ignite, will not give rise to smoke or toxic or explosive hazards at elevated temperatures, this being determined in accordance with the *Fire Test Procedure Code*, Annex 1, Part 6.

### **6.1.1.2.7 Furniture in Stairway Enclosures**

Furniture in stairway enclosures shall be limited to seating. It shall be fixed, limited to six seats on each deck in each stairway enclosure, made of materials resistant to the ignition and propagation of flame, determined in accordance with the *FTP Code*, Annex 1, Part 8, and shall not restrict passenger escape routes. Additional seating is permitted in the main reception area within a stairway enclosure if it is fixed, non-combustible and does not restrict the passenger escape routes.

Furniture shall not be permitted in passenger and crew corridors forming escape routes in cabin areas. However, lockers of non-combustible materials, providing storage for non-hazardous safety equipment may be used.

Drinking water dispensers and ice cube machines are permitted in corridors provided they are fixed and do not restrict the width of the escape routes. This also applies to decorative flower or plant arrangements, statues or other objects of art such as paintings and tapestries in corridors and stairways.

### **6.1.1.2.8 Furniture and Furnishings on Cabin Balconies of Passenger Ships**

Furniture and furnishings on cabin balconies, except for natural hard wood decking systems and exposed surfaces of divisions and linings shall fulfil the requirements for the spaces with furniture and furnishings of low fire risk specified in the definition 1.2.57. If this cannot be fulfilled, such balconies shall be protected by a fixed fire detection and fire alarm and fixed pressure water-spraying systems – see 6.1.11.3.

## **6.1.1.3 Means of Control in Machinery Spaces of Category A**

### **6.1.1.3.1 Means of control shall be provided for:**

- .1** opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation and closure of ventilator dampers;
- .2** stopping ventilating fans of machinery space ventilating system,

- .3 stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service pumps, thermal oil circulating pumps and oil separators;
- .4 closing oil fuel pipes' valves for storage, settling and daily service tanks situated in the machinery space above the double bottom;
- .5 switching on ventilating fans intended for release of smoke from machinery space;
- .6 closing power-operated doors or actuating release mechanism on doors other than power-operated watertight doors.

**6.1.1.3.2** Means of control, specified in 6.1.1.3.1, shall be located outside machinery spaces, where they will not be cut off in the event of fire in the spaces they serve. Such controls and the controls for any required fire-extinguishing system shall be situated at one control position or grouped in as few positions as possible. Such positions shall have a safe access from the open deck.

**6.1.1.3.3** The location of control devices in machinery spaces of category A shall be indicated by a plate with the symbol used on *Fire Control Plan*.

#### **6.1.1.4 Paints and Flammable Liquids Store-Rooms**

On passenger ships carrying more than 36 passengers, store-rooms for paints and flammable liquids shall be classified in category (14) – other space where flammable liquids are stored listed in 6.1.4. Divisions and decks shall be of Class A and of fire integrity required for fire divisions depending on the category of the adjacent spaces.

Such store-rooms shall not be located in way of accommodation spaces.

#### **6.1.1.5 Galleys**

Main galleys shall be classified as follows:

- on passenger ships carrying more than 36 passengers – in category (12), i.e. machinery spaces and main galleys, listed in 6.1.4;
- on passenger ships carrying not more than 36 passengers – in category (9), i.e. service spaces of greater fire risk, listed in 6.1.5.

Divisions and deck forming boundaries of such galleys shall be constructed from steel and of Class A and of fire integrity required for fire divisions depending on the category of the adjacent spaces in accordance with tables included in sub-chapters 6.1.4 and 6.1.5.

Lining of the ceiling in galleys shall be constructed from a non-combustible material and shall be readily removable for cleaning the covered spaces where dust and grease may accumulate.

#### **6.1.1.6 Open Deck Areas**

On passenger ships carrying more than 36 passengers, the guidelines for evaluation of fire risk of external areas, contained in the Annex to IMO

MSC.1/Circ.1274, shall be taken into consideration during the design of open deck areas (promenades, passenger areas for recreation and rest).

### **6.1.1.7 Construction and Arrangement of Saunas**

**6.1.1.7.1** The perimeter of the sauna shall be of A Class boundaries and may include changing rooms, showers and toilets. The sauna shall be insulated to A-60 standard against other spaces except those inside of the perimeter and spaces of categories (5), (9) and (10), specified in 6.1.4.2.

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

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

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

**6.1.1.7.5** The sauna door shall open outwards by pushing.

**6.1.1.7.6** Electrically heated ovens shall be provided with a timer.

### **6.1.2 Main Vertical Zones and Horizontal Zones**

**6.1.2.1** On passenger ships carrying more than 36 passengers, the hull, superstructures and deckhouses shall be subdivided into main vertical zones by A-60 Class divisions. Steps and recesses shall be kept to a minimum, but where they are necessary, they shall also be A-60 Class divisions.

Where at one side of the main vertical zone division, there are spaces of category (5), (9) or (10) – listed in 6.1.4 – the fire integrity standard of the division may be reduced to A-0.

Fire integrity standard of the main vertical zone division may be also reduced to A-0 where oil fuel tanks are installed at both sides of the division.

**6.1.2.2** On ships carrying not more than 36 passengers, the hull, superstructures and deckhouses in way of accommodation and service spaces shall be subdivided into main vertical zones by A Class divisions. These divisions shall have fire integrity in accordance with Tables 6.1.5-1 and 6.1.5-2.



**6.1.2.3** The main vertical zone divisions above the bulkhead deck shall be in line, as far as practicable with watertight subdivision bulkheads situated immediately below the bulkhead deck.

The length and width of the main fire division shall generally not exceed 40 m.

**6.1.2.4** The length and breadth of the main vertical zones may be increased to maximum 48 m so that the boundaries of the main vertical zones are in line with watertight bulkheads or that large public spaces are situated in a single zone over its whole length, provided that the total surface area of the main vertical zone on any deck does not exceed 1600 m<sup>2</sup>. The length or width of the main vertical zone is the maximum distance between the furthestmost points forming the division.

**6.1.2.5** If a stairway serves two main vertical zones, the maximum length of one main vertical zone shall be measured from the far side of the main vertical zone stairway enclosure. In that case, all boundaries of the stairway enclosure shall be insulated as main vertical zone bulkheads and access doors leading into the stairway shall be provided from each vertical zone. The stairway, however, need not be included in calculating the size of the main vertical zone if it is treated as its own main vertical zone<sup>1)</sup>.

**6.1.2.6** The number of main zone divisions of 48 m maximum length is not limited as long as they comply with all the applicable requirements.

**6.1.2.7** Main vertical zone divisions shall extend from the outer plating of one side to the outer plating of the other side or other A-60 Class division and from deck to deck in each 'tweendeck' space.

**6.1.2.8** Where a main vertical zone is subdivided by horizontal 'A' Class divisions into horizontal zones for the purpose of providing an appropriate barrier between zones protected by automatic sprinkler systems and non-sprinklered zones of the ship, the horizontal divisions shall extend between adjacent main vertical zone bulkheads and to the shell plating or exterior boundaries of the ship and shall be insulated in accordance with the fire insulation and integrity values specified in Table 6.1.4-2 – for ships carrying more than 36 passengers, and in Table 6.1.5-2 – for ships carrying not more than 36 passengers.

**6.1.2.9** In ships designed for special purposes, such as automobile or railroad car ferries where the provision of main vertical zone bulkheads would defeat the purpose for which the ship is intended, equivalent protection, approved by PRS, shall be provided by dividing a space into horizontal zones.

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<sup>1)</sup> Interpretations regarding the arrangement of stairways with respect to the main fire divisions and determining the length of these divisions are given in MSC/Circ.1120 for SOLAS regulation II-2/9.2.2.1, see Appendix, figures 1 to 4.

Service spaces and ship stores shall not be located on ro-ro decks unless protected in accordance with the applicable requirements.

**6.1.2.10** In ships with special category spaces, any such space shall additionally fulfil the relevant requirements specified in sub-chapter 6.10.2. Where such compliance would be inconsistent with the requirements of sub-chapter 6.1, the requirements specified in sub-chapter 6.10.2 shall prevail.

### **6.1.3 Bulkheads within Main Vertical Zones**

**6.1.3.1** On ships carrying more than 36 passengers, all bulkheads which are not required to be A Class divisions shall be at least B Class or C Class divisions as prescribed in sub-chapter 6.1.4.

**6.1.3.2** On ships carrying not more than 36 passengers, all bulkheads in way of the accommodation spaces and service spaces which are not required to be A Class divisions shall be at least B Class or C Class divisions in accordance with the requirements specified in sub-chapter 6.1.5.

Additionally, all corridor boundaries where not required to be A Class shall be B Class divisions and shall extend from deck to deck, except that:

- .1** where continuous B Class ceilings or linings are fitted on both sides of the bulkhead, the portion of the bulkhead behind the continuous ceiling or lining shall be of a material which, in thickness and composition, is acceptable in the construction of B Class divisions but which shall be required to meet B Class integrity standards only in so far as is reasonable and practicable in the opinion of PRS<sup>1)</sup>; and
- .2** where a ship is protected by an automatic sprinkler system in accordance with the requirements specified in 3.3, the corridor bulkheads may terminate at a ceiling in the corridor, provided that such bulkheads and ceilings are of B Class standard and comply with the requirements specified in sub-chapter 6.1.5. All doors and frames in such bulkheads shall be of non-combustible materials and shall have the same fire integrity as bulkheads in which they are fitted.

**6.1.3.3** Bulkheads required to be B Class divisions, except corridor bulkheads, specified in 6.1.3.2, shall extend from deck to deck and from shell to shell or other boundaries unless continuous B Class ceilings or linings fitted on both sides of the

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<sup>1)</sup> The extension of the bulkhead shall be made of non-combustible material and the construction of the extension shall correspond to the fire class of extended bulkhead. Where extension of the division is of B-0 Class, it may be constructed of steel sheet with 1 mm in thickness, provided it is properly covered (e.g. with rockwool). Alternatively, extension of B-0 division may be made of rockwool (having a mass density not less than 100 kg/m<sup>3</sup> and 50 mm in thickness), provided it is properly supported and fixed.

bulkhead are at least of the same fire integrity as the bulkhead, in which case the bulkhead may terminate at the continuous ceiling or lining<sup>2)</sup>.

If an air gap between cabins results in an opening in the continuous B-15 Class ceiling, the bulkheads on both sides of the air gap shall be of B-15 Class standard.

**6.1.3.4** Atriums shall be protected by fire divisions as follows:

- .1 the atrium shall be within enclosures formed of A Class divisions having the fire integrity as prescribed in Tables 6.1.4-1 and 6.1.5-1;
- .2 decks separating spaces within the atrium shall have the fire integrity as prescribed in Tables 6.1.4-2 and 6.1.5-2, depending on the adjacent spaces category.

#### **6.1.4 Fire Integrity of Bulkheads and Decks in Ships Carrying more than 36 Passengers**

**6.1.4.1** The minimum fire integrity of vertical divisions and bulkheads separating adjacent spaces shall fulfil the requirements specified in Table 6.1.4-1, whereas of decks separating adjacent spaces – with the requirements specified in Table 6.1.4-2.

Where, due to any particular structural arrangements in the ship, difficulty is experienced in determining, from the Tables, the minimum fire integrity value of any division, such values shall be agreed with PRS.

**6.1.4.2** The principles, specified in 2.2.2.2, as well as those given below, shall govern the application of the Tables.

With respect to category (5) spaces – the application of the requirements for fire integrity of Table 6.1.4-1 to the external bulkheads of deckhouses and superstructures, and of Table 6.1.4-2 to open decks, shall be agreed with PRS in each particular case. In no case the requirements of category (5) of the tables, referred to above, necessitate enclosure of spaces which need not be enclosed.

Spaces have been subdivided into 14 categories according to their fire risk:

(1) **Control stations:**

- spaces containing emergency sources of power and lighting (battery rooms and spaces containing emergency power generating units);
- navigation bridge and chartroom, including navigation equipment room (radar transmitter);
- spaces containing the ship's radio equipment;
- fire control station;
- control rooms for propulsion machinery when located outside the propulsion machinery space;
- spaces containing centralised fire alarm equipment;
- spaces containing centralised public address system stations and equipment.

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<sup>2)</sup> Guidelines for the construction of bulkheads within accommodation spaces in the main vertical zone are given in MSC/Circ.917/Corr.1

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- (2) **Stairways** – interior stairways, lifts, totally enclosed emergency escape trunks and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto. A stairway which is enclosed at one level only shall be regarded as part of the space from which it is not separated by a fire door.
- (3) **Corridors** – passenger and crew corridors and lobbies.
- (4) **Embarkation stations and external escape routes:**
- lifeboat and liferaft stations;
  - open deck spaces and enclosed promenades forming lifeboat and liferaft embarkation and lowering stations;
  - internal and external assembly stations;
  - external stairs and open decks used for escape routes;
  - ship's sides to the minimum draught waterline, superstructures and deckhouses situated below or in the vicinity of liferafts and escape chutes.
- (5) **Open deck spaces:**
- open deck spaces and enclosed promenades clear of lifeboat and liferaft embarkation and lowering stations. The enclosed promenades shall constitute no fire risk, meaning that furnishings shall be restricted to deck furniture. In addition, such spaces shall be naturally ventilated by permanent openings;
  - air spaces (the spaces outside superstructures and deckhouses).
- (6) **Accommodation spaces of minor fire risk:**
- cabins containing furniture and furnishings of restricted fire risk;
  - offices and dispensaries containing furniture and furnishings of restricted fire risk;
  - public spaces containing furniture and furnishings of restricted fire risk and having a deck area of less than 50 m<sup>2</sup>.
- (7) **Accommodation spaces of moderate fire risk:**
- spaces as in category (6), however containing furniture and furnishings of other than restricted fire risk;
  - public spaces containing furniture and furnishing of restricted fire risk and having a deck area of 50 m<sup>2</sup> or more;
  - isolated lockers and small store-rooms in accommodation spaces having areas less than 4 m<sup>2</sup> (in which flammable liquids are not stowed);
  - motion picture projection and film stowage rooms;
  - diet galleys (containing no open flame)<sup>1)</sup>;
  - cleaning gear lockers (in which flammable liquids are not stowed);
  - laboratories (in which flammable liquids are not stowed);
  - pharmacies;
  - small drying rooms (having a deck area of 4 m<sup>2</sup> or less);

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<sup>1)</sup> Such galleys shall not contain appliances listed in footnote <sup>1)</sup> to 1.2.51.

- specie rooms;
  - operating rooms;
  - identifiable spaces containing electrical distribution boards (having a deck area of 4 m<sup>2</sup> or less).
- (8) **Accommodation spaces of greater fire risk:**
- public spaces containing furniture and furnishings of other than restricted fire risk and having a deck area of 50 m<sup>2</sup> or more;
  - hair-dresser’s shops and beauty parlours;
  - saunas.
  - sale shops.
- (9) **Sanitary and similar spaces:**
- communal sanitary facilities, showers, baths, water closets, etc.;
  - small laundry rooms;
  - indoor swimming pool areas;
  - isolated pantries containing no cooking appliances in accommodation spaces – see the definition given in 1.2.51;
- Note:** Private sanitary facilities shall be considered a portion of the space in which they are located.
- (10) **Tanks, voids and auxiliary machinery spaces having little or no fire risk:**
- water tanks forming part of the ship’s structure;
  - voids and cofferdams;
  - auxiliary machinery spaces which do not contain machinery having a pressure lubrication system and where storage of combustibles is prohibited, such as:
    - ventilation fans and air conditioning rooms,
    - windlass room,
    - steering gear room,
    - stabiliser equipment room,
    - thruster room,
    - electrical propulsion motor room,
    - rooms containing section switchboards and purely electrical equipment other than oil-filled electrical transformers (above 10 kVA),
    - shaft alleys and pipe tunnels,
    - spaces for pumps and refrigeration machinery, not handling or using flammable liquids;
  - closed trunks serving the spaces listed above, as well as other trunks, such as pipe and cable trunks.
- (11) **Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk:**
- cargo oil tanks;
  - cargo holds, trunkways and hatchways;
  - refrigerated chambers;
  - oil fuel tanks (where installed in a separate space with no machinery);

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- shaft alleys and pipe tunnels allowing storage of combustibles;
  - auxiliary machinery spaces as in category (10) which contain machinery having a pressure lubrication system or where storage of combustibles is permitted;
  - oil fuel filling stations;
  - spaces containing oil-filled electrical transformers (above 10 kVA);
  - spaces containing turbine or reciprocating steam engine driven auxiliary generators and small internal combustion engines of the power output up to 110 kW driving emergency generators, sprinkler, water-spraying or fire pumps, bilge pumps, etc.;
  - closed trunks serving the spaces listed above.
- (12) **Machinery spaces and main galleys:**
- main propulsion machinery rooms (other than electric propulsion motor rooms) and boiler rooms;
  - auxiliary machinery spaces other than those in categories (10) and (11) which contain internal combustion machinery or other oil-burning, heating or pumping units;
  - main galleys and annexes;
  - trunks and casings to the spaces listed above.
- (13) **Store-rooms, workshops, pantries, etc.:**
- main pantries not annexed to galleys – see the definition given in 1.2.56, including the footnote;
  - main laundry;
  - large drying rooms, having a deck area of more than 4 m<sup>2</sup>;
  - miscellaneous store-rooms;
  - mail and baggage rooms;
  - garbage rooms;
  - workshops, not forming part of machinery spaces, galleys, etc.;
  - lockers and store-rooms having areas greater than 4 m<sup>2</sup>, not intended for the storage of flammable liquids;
  - refrigerated provision chambers;
  - garbage handling and storage spaces.
- (14) **Other spaces in which flammable liquids are stowed:**
- paint lockers;
  - store-rooms containing flammable liquids (including dyes, medicines, etc.);
  - laboratories (in which flammable liquids are stowed).







**Notes to Table 6.1.4-1 and Table 6.1.4-2:**

- a) Where adjacent spaces are in the same numerical category, a bulkhead or deck between such spaces may not be fitted if deemed unnecessary by PRS. For example, in category (12) a bulkhead need not be required between a galley and its annexed pantries provided the pantry bulkhead and decks maintain the integrity of the galley boundaries. A bulkhead is, however, required between a galley and machinery space even though both spaces are in category (12).
- b) The ship's side, to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to liferafts and evacuation slides may be reduced to A-30 Class.
- c) Where public toilets are installed completely within the stairway enclosure, the public toilet bulkhead within the stairway enclosure may be of B Class integrity.
- d) Where spaces of categories (6), (7), (8) and (9) are located completely within the outer perimeter of the assembly station, the bulkheads of these spaces are permitted to be of B-0 Class integrity. Control positions for audio, video and light installations may be considered as part of the assembly station.

**6.1.5 Fire Integrity of Bulkheads and Decks in Ships Carrying not more than 36 Passengers**

**6.1.5.1** The minimum fire integrity of bulkheads separating adjacent spaces shall be in accordance with Table 6.1.5-1, whereas the minimum fire integrity of decks – in accordance with Table 6.1.5-2.

**6.1.5.2** The requirements specified in paragraph 2.2.2.2 shall govern application of the above mentioned tables.

Adjacent spaces have been subdivided into 11 categories according to their fire risk:

- (1) **Control stations:**
  - spaces containing emergency sources of power and lighting (battery rooms and spaces containing emergency power generating units);
  - wheelhouse and chartroom including the space containing radar transmitter;
  - spaces containing the ship's radio equipment;
  - fire control stations;
  - control rooms for propulsion machinery, where located outside the machinery space;
  - spaces containing centralised fire alarm equipment.
- (2) **Corridors** – passenger and crew corridors and lobbies.
- (3) **Accommodation spaces** – see 1.2.51, excluding corridors.
- (4) **Stairways** – interior stairways, lifts, totally enclosed emergency escape trunks and escalators (except those wholly contained within the machinery spaces) and enclosures thereto. A stairway which is enclosed at one level only shall be regarded as part of the space from which it is not separated by a fire door.
- (5) **Service spaces (low fire risk):**
  - lockers and store-rooms having areas less than 4 m<sup>2</sup>, not having provisions for the storage of flammable liquids, as well as drying rooms and laundries;

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- identifiable spaces containing distribution boards having a deck area of less than 4 m<sup>2</sup>.
- (6) **Machinery spaces of category A** – see 1.2.65.
- (7) **Other machinery spaces:**
- machinery spaces, specified in sub-chapter 1.2.64, excluding machinery spaces of category A;
  - electrical equipment rooms (e.g. auto-telephone exchange, air-conditioning duct spaces).
- (8) **Cargo spaces** – all spaces used for cargo (including cargo oil tanks) and trunkways and hatchways to such spaces other than special category spaces.
- (9) **Service spaces (high fire risk)** – galleys, pantries containing cooking appliances (see the definition given in 1.2.56, including the footnote), paint and readily ignitable material rooms, lockers and store-rooms having areas of 4 m<sup>2</sup> or more, flammable liquids store-rooms, saunas, as well as workshops other than those forming part of the machinery spaces, garbage handling and storage scraps.
- (10) **Open decks:**
- open deck spaces and enclosed promenades having little or no fire risk. To be considered in this category, the enclosed promenades shall constitute no significant fire risk, meaning that furnishings shall be restricted to deck furniture. In addition, such spaces shall be naturally ventilated by permanent openings;
  - air spaces (spaces outside superstructures and deckhouses).
- (11) **Special category and ro-ro spaces** – see 1.2.49 and 1.2.54.

**6.1.5.3** External boundaries which are required in 2.1.1 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 passenger 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 regarded as suitable.

**6.1.5.4** The construction and the arrangements of saunas shall comply with the requirements specified in 6.1.1.7. The sauna shall be insulated to A-60 standard against other spaces except those inside of the perimeter and spaces of categories (5), (7) and (10), specified in 6.1.5.2.



**Table 6.1.5-2**  
**Fire integrity of decks separating adjacent spaces**

Space below ↓	Space above →	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations	(1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0	*	A-30
Corridors	(2)	A-0	*	*	A-0	*	A-60	A-0	A-0	A-0	*	A-0
Accommodation spaces	(3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0	A-0	*	A-30 A-0 <sup>d)</sup>
Stairways	(4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0	A-0	*	A-0
Service spaces (low fire 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 <sup>d)</sup>	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 <sup>d)</sup>	A-0	*	A-0	*	A-0
Service spaces (high fire risk)	(9)	A-60	A-30 A-0 <sup>d)</sup>	A-30 A-0 <sup>d)</sup>	A-30 A-0 <sup>d)</sup>	A-0	A-60	A-0	A-0	A-0	*	A-30
Open decks	(10)	*	*	*	*	*	*	*	*	*	–	A-0
Special category spaces and ro-ro spaces	(11)	A-60	A-15	A-30 A-0 <sup>d)</sup>	A-15	A-0	A-30	A-0	A-0	A-30	A-0	A-0

**Notes to Table 6.1.5-1 and Table 6.1.5-2:**

- a) For clarification of the division type – see paragraphs 2.2.3 and 2.2.4.
- b) Where spaces are of the same numerical category, 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 other galley does not require a bulkhead, but a galley next to a paint room requires A-0 bulkhead.
- c) Bulkheads separating the navigation bridge, chartroom from each other may be of B-0 rating. No fire rating is required for the partitions separating the navigation bridge and the safety centre when the latter is within the navigation bridge.
- d) In determining the applicable fire integrity standard of a boundary between two spaces both of which are protected by automatic sprinkler systems, in accordance with the requirements specified in sub-chapter 3.3, the lesser of the two values given in the tables may apply.
- e) Where the particular division forms a boundary of the main vertical fire zone in accordance with the requirements specified in paragraph 6.1.2.1, Class A-0 shall apply.
- f) If the machinery space in category (7) has little fire risk, Class A-0 may apply. For determining such machinery space – see 6.1.4.2(10).
- \* Where an asterisk appears in the tables, the division is required to be of steel or other equivalent material, although it is not required to be of A Class standard. However, where a deck, except in a category (10) space, is penetrated for the passage of electric cables, pipes and vent ducts, such penetrations shall be made tight to prevent the passage of flame and smoke. Divisions between control stations (emergency generators) and open decks may have air intake openings without means for closure, unless a fixed gas fire-fighting system is fitted.

## 6.1.6 Means of Escape

### 6.1.6.1 Width of Stairways

Stairways shall be not less than 900 mm in clear width. The minimum clear width of stairways shall be increased by 10 mm for every one person provided in excess of 90 persons. The maximum clear width between handrails shall not exceed 1800 mm. The total number of persons to be evacuated by such stairways shall be assumed to be two thirds of the crew and the total number of passengers in the areas served by such stairways. The width of stairway shall be calculated in accordance with the provisions of the *FSS Code*, Chapter 13, paragraph 2.1.2.

The stairway shall not decrease in width in the direction of evacuation to the assembly station, except in the case of several assembly stations in one main vertical zone – the stairway width shall not decrease in the direction of the evacuation to the most distant assembly station.

### 6.1.6.2 Handrails

Stairways shall be fitted with handrails on each side. The maximum clear width between handrails shall be 1800 mm.

### 6.1.6.3 Alignment of Stairways

All stairways sized for more than 90 persons shall be aligned fore and aft.

#### 6.1.6.4 Vertical Rise and Inclination

Stairways shall not exceed 3.5 m in vertical rise without the provision of a landing and shall not have an angle of inclination greater than 45°.

#### 6.1.6.5 Landings

Landings at each deck level shall be not less than 2 m<sup>2</sup> in area and shall be increased by 1 m<sup>2</sup> for every 10 persons provided for in excess of 20 persons, however need not exceed 16 m<sup>2</sup>, except for those landings servicing public spaces having direct access to the stairway enclosure. Intermediate landings shall be sized in the same manner as stairways.

#### 6.1.6.6 Doorways and Corridors

Doorways<sup>1</sup>, corridors and intermediate landings included in means of escape shall be sized in the same manner as stairways.

Aggregate width of stairway exit doors to the assembly station shall not be less than the aggregate width of stairways serving this deck.

#### 6.1.6.7 Evacuation Routes to Embarkation Deck

It shall be recognised that the evacuation routes to the embarkation deck may include an assembly station. In that case, consideration shall be given to the fire protection requirements and sizing of corridors and doors from the stairway enclosure to the assembly station and from the assembly station to the embarkation deck, noting that evacuation of persons from assembly stations to embarkation positions will be conducted in small controlled groups.

#### 6.1.6.8 Routes from Assembly Station to Survival Craft Embarkation Position

Where passengers and crew are held at an assembly station which is not at the survival craft embarkation position, the dimension of stairway width and doors from the assembly station to this position shall not be based on the number of persons in the controlled group. The width of these stairways and doors need not exceed 1.5 m unless larger dimensions are required for evacuation of these spaces under normal conditions.

#### 6.1.6.9 Means of Escape Plans

For each ship, *Means of Escape Plan* shall be provided indicating the following:

- .1 number of crew and passengers in all normally occupied spaces;
- .2 number of crew and passengers expected to escape by stairway and through doorways, corridors and landings;
- .3 assembly stations and survival craft embarkation positions

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<sup>1)</sup> Not applicable to cabin doors.

- .4 primary and secondary means of escape;
- .5 width of stairways, doors, corridors and landing areas.

*Means of Escape Plan* shall be accompanied by detailed calculation for determining the width of escape stairways, doors, corridors and landings.

It is recommended that the width of each means of escape be calculated in accordance with an evacuation analysis based on the guidelines specified in MSC.1/Circ.1238.

#### **6.1.6.10 Means of Escape from Accommodation Spaces, Service Spaces and Control Stations**

##### **6.1.6.10.1 Escape from Spaces below Bulkhead Deck**

**6.1.6.10.1.1** Below the bulkhead deck two means of escape, at least one of which shall be independent of watertight doors, shall be provided from each watertight compartment or similarly restricted space or group of spaces. In well-grounded cases, one of the means of escape for crew spaces that are entered only occasionally may be waived if the required escape route is independent of watertight doors.

**6.1.6.10.1.2** Where, in accordance with 6.1.6.10.1.1, PRS has waived the requirement to provide two means of escape, this sole means of escape shall provide safe escape. However, stairways shall not be less than 0.8 m in clear width with handrails on both sides.

##### **6.1.6.10.2 Escape from Spaces Above Bulkhead Deck**

Above the bulkhead deck there shall be at least two means of escape from each main vertical zone or similarly restricted space or group of spaces at least one of which shall give access to a stairway forming a vertical escape.

##### **6.1.6.10.3 Direct Access to Stairway Enclosures**

Stairway enclosures in accommodation and service spaces shall have direct access from the corridors and be of a sufficient area to prevent congestion, having in view the number of persons likely to use them in an emergency. Within the perimeter of such stairway enclosures, only public toilets, lockers of non-combustible material providing storage for nonhazardous safety equipment and open information counters are permitted.

Only corridors, lifts, public toilets, special category spaces and open ro-ro spaces to which any passengers can have access, other than escape stairways required by 6.1.6.10.4.1 and external areas are permitted to have direct access to these stairway enclosures and external areas.

Public spaces may also have direct access to stairway enclosures, except for the backstage spaces of a theatre.

Small corridors or "lobbies" used to separate an enclosed stairway from galleys or main laundries may have direct access to the stairway, provided they have a minimum deck area of 4.5 m<sup>2</sup>, a width of not less than 0.9 m and contain a fire hose station.

#### 6.1.6.10.4 Details of Means of Escape

Means of escape shall fulfil the following requirements:

- .1 at least one of the means of escape (from the spaces located below and above the bulkhead deck) required by 6.1.6.10.1.1 and 6.1.6.10.2 shall consist of a readily accessible enclosed stairway, which shall provide continuous fire shelter from the level of its origin to the appropriate lifeboat and liferaft embarkation decks, or to the uppermost weather deck if the embarkation deck does not extend to the main vertical zone<sup>1)</sup> being considered. In the latter case, direct access to the embarkation deck by way of external open stairways and passageways shall be provided and shall have emergency lighting and slip-free surfaces underfoot. Boundaries facing external open stairways and passageways forming part of an escape route and boundaries in such a position that their failure during a fire would impede escape to the embarkation deck shall have fire integrity, including insulation values, in accordance with Tables 6.1.4-1 and 6.1.4-2, as appropriate;
- .2 access from the stairway enclosures to the lifeboat and liferaft embarkation areas shall be provided either directly or through internal routes which have fire integrity and insulation values for stairway enclosures as determined by Tables 6.1.4 and 6.1.5, as appropriate;
- .3 stairways serving only a space and a balcony in that space shall not be considered as forming one of the required means of escape;
- .4 each level within an atrium shall have two means of escape, one of which shall give direct access to an enclosed vertical means<sup>2)</sup> of escape meeting the requirements specified in sub-paragraph .1;
- .5 widths, number and continuity of escapes shall be in accordance with the requirements in the *FSS Code*, Chapter 13.

#### 6.1.6.10.5 Marking of Escape Routes

In addition to the emergency lighting, in passenger accommodation spaces, the means of escape, including stairways and exits, shall be marked by low-location lighting or photoluminescent strip indicators placed not more than 0.3 m above the deck at all points of the escape route including angles and intersections. The

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<sup>1)</sup> Interpretations regarding the construction of continuous fire shelter are given in MSC/Circ.1120, for *SOLAS* regulation II-2/13.3.2.4.1, see the figure in the Appendix.

<sup>2)</sup> Such enclosed means of escape shall be sized taking into account the total number of persons at each level of the atrium considered.



lighting must enable passengers to identify the routes of escape and readily identify the escape exits. If electric illumination is used, it shall be supplied by the emergency source of power and it shall be so arranged that the failure of any single light or cut in a lighting strip will not result in the marking being ineffective. The low-location lighting of escape routes shall fulfil the requirements specified in 22.1.4, *Part VIII – Electrical Installations and Control Systems*, as well as Res. A.752(18).

In passenger ships carrying more than 36 passengers, the marking of escape routes shall also be provided in the crew accommodation spaces.

The marking of escape routes, required in 2.3.1.7, in passenger accommodation spaces shall be visible and easy to read for persons with reduced mobility, especially for wheelchair users.

In lieu of marking the escape routes by low-location lighting system or photoluminescent strip indicators, alternative evacuation guidance system complying with the requirements specified in MSC/Circ. 1167 and type approved in accordance with the guidelines set forth in MSC/Circ. 1168, may be accepted.

#### **6.1.6.10.6 Normally Locked Doors that Form Part of Escape Route**

Cabin and stateroom doors shall not require keys to unlock them from inside the room. Neither shall there be any doors along any designated escape route which require keys to unlock them when moving in the direction of escape.

Escape doors from public spaces that are normally latched shall be fitted with a means of quick release. Such means shall consist of a door-latching mechanism incorporating a device that releases the latch upon the application of a force in the direction of escape flow. Quick release mechanism shall:

- .1 consist of bars or panels, whose actuating portion extends across at least one half of the width of the door leaf, at least 760 mm and not more than 1120 mm above the deck;
- .2 cause the latch to release when a force not exceeding 67 N is applied to the releasing device; and
- .3 not be equipped with any locking device, set screw or other arrangement that prevents the release of the latch when pressure is applied to the releasing device.

#### **6.1.6.10.7 Adjustment of Escape Routes for Persons with Reduced Mobility**

In public spaces and in passenger accommodation areas, means of escape to embarkation station, especially corridors with handrails, passageways, doorways and doors shall be made in such a way as to accommodate the movement of persons with reduced mobility, especially wheelchair users. When designing escape routes “Recommendation on the design and operation of passenger ships to respond to elderly and disabled persons’ needs” contained in MSC/Circ.735 shall be taken into account.

#### **6.1.6.10.8 Means of Escape from Accommodation Spaces on Open Decks**

In passenger ships carrying more than 36 passengers, two means of escape, as widely separated as possible, shall be provided from all accommodation areas on open decks.

#### **6.1.6.11 Means of Escape from Machinery Spaces**

In each machinery space, two means of escape shall be provided in accordance with the requirements specified in the present sub-chapter.

##### **6.1.6.11.1 Escape from Spaces below Bulkhead Deck**

Where the machinery space is below the bulkhead deck, the two means of escape shall consist of either:

- .1** two sets of steel stairways or ladders<sup>1)</sup>, as widely separated as possible, leading to doors in the upper part of the machinery space and from which access is provided to the appropriate lifeboat and liferaft embarkation deck. One of these stairways or ladders shall be located within a protected enclosure having the fire integrity as required for stairways in 6.1.4, category (2) and 6.1.5, category (4), from the lower part of the machinery space to a safe position outside the space. This enclosure shall be provided with self-closing doors of the same fire integrity standard. The ladder or stairway shall be fixed in such away that heat is not transferred into the enclosure through non-insulated fixing points. The protected enclosure shall have a free opening of at least 800 mm x 800 mm including provision for a ladder and shall be provided with emergency lighting; or
- .2** one steel stairway or ladder leading to doors in the upper part of the machinery space from which access is provided to the lifeboat and liferaft embarkation deck and additionally, in the lower part of the space and in a position well separated from the stairway or ladder referred to, a steel door capable of being operated from each side and which provides access to the lifeboat and liferaft embarkation deck.

In machinery spaces, stairways which are not located within a protected enclosure shall provide a continuous fire shelter from the level of its origin.

##### **6.1.6.11.2 Escape from Spaces above the Bulkhead Deck**

Where the space is above the bulkhead deck, the two means of escape shall be as widely separated as possible and the doors leading from such means of escape shall be in a position from which access is provided to the appropriate lifeboat and liferaft embarkation decks. Where such means of escape require the use of ladders, these shall be of steel.

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<sup>1)</sup> Ladders having strings of flexible steel wire ropes are not acceptable in such escape routes.

### **6.1.6.11.3 Dispensation from Two Means of Escape**

In ships of less than 1,000 gross tonnage, one means of escape from the machinery space may be considered sufficient, due regard being paid to the width and disposition of the upper part of the space.

In ships of 1,000 gross tonnage and above, one means of escape from a normally unattended auxiliary machinery space may be considered sufficient, so long as either a door or a steel ladder provides a safe escape route to the embarkation deck, due regard being paid to the nature and location of the space and whether persons are normally employed in that space. This requirement applies only to auxiliary machinery spaces where persons are not normally employed.

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

### **6.1.6.11.4 Escape from Machinery Control Rooms**

Two means of escape shall be provided from the machinery control room located within a machinery space, at least one of which will provide a continuous fire shelter to a safe position outside the machinery space.

### **6.1.6.11.5 Escape from other Enclosed Compartments within Machinery Spaces**

From enclosed spaces<sup>1)</sup> located within machinery space, such as for monitoring of operation of machinery, and from work spaces in which person are normally employed, there shall be at least two means of escape, one of which shall be independent of the machinery space and give access to the embarkation deck.

### **6.1.6.12 Location of Emergency Escape Breathing Devices**

**6.1.6.12.1** In all passenger ships, at least two emergency escape breathing devices, complying with the requirement specified in 5.1.5, shall be situated in each main vertical zone.

**6.1.6.12.2** In passenger ships carrying more than 36 passengers, two emergency escape breathing devices, in addition to those required in 6.1.6.12.1, shall be carried in each main vertical fire zone.

**6.1.6.12.3** The requirements, specified in paragraphs 6.1.6.12.1 and 6.1.6.12.2, do not apply to stairway enclosures which constitute individual main vertical zones and to the main vertical zones in the fore and aft end of a ship which do not contain spaces of categories (6), (7), (8) or (12), defined in 6.1.4.

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<sup>1)</sup> An enclosed space is a space having less than 30% of communication openings with machinery space.

### **6.1.7 Protection of Stairways and Lifts in Accommodation and Service Spaces and Control Stations**

**6.1.7.1** Stairways shall be within enclosures formed of A Class divisions, with positive means of closure at all openings, except that:

- .1** a stairway connecting only two decks need not be enclosed, provided the integrity of the deck is maintained by proper bulkheads or self-closing doors in one 'tweendeck space. Where a stairway is closed in one 'tweendeck space, the stairway enclosure shall be protected in accordance with Table 6.1.4-1 or Table 6.1.5-1;
- .2** stairways may be fitted in the open in a public space, provided they lie wholly within the public space.

**6.1.7.2** Lift trunks shall be so fitted as to prevent the passage of smoke and flame from one 'tweendeck to another and shall be provided with means of closing so as to permit the control of draught and smoke.

Machinery for lifts located within stairway enclosures shall be arranged in a separate room, surrounded by steel boundaries, except that small passages for lift cables are permitted.

Lifts which open into spaces other than corridors, public spaces, special category spaces, stairways and external areas (e.g. provision chambers, galleys, machinery spaces) shall not open into stairways included in the means of escape.

### **6.1.8 Means of Closing of Openings in Class A Fire Divisions**

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

**6.1.8.2** Construction of fire doors and door frames in A Class divisions, with the means of securing them when closed, shall provide resistance to fire as well as to the passage of smoke and flame equivalent to that of the bulkheads in which the doors are situated, this being determined in accordance with the *FTP Code*, Annex 1, Part 3. Such doors and door frames shall be constructed of steel or other equivalent material.

Fire doors approved as A Class doors without the sill being part of the frame shall be so installed that the gap under the door does not exceed 12 mm and a non-combustible sill shall be installed under the door such that floor coverings do not extend beneath the closed door.

Where required divisions are replaced by divisions of a higher standard, the door need only conform to the required division.

Watertight doors need not be insulated. Watertight doors, regarded as fire doors, in A Class divisions need not be fire-tested in accordance with the *FTP Code*

where intended for use below the bulkhead deck, provided they fulfil the relevant watertightness requirements. Where such doors are used at locations above the bulkhead deck, they shall fulfil the relevant watertightness and fire integrity requirements, this being determined in accordance with the *FTP Code*.

Where a watertight door is located adjacent to a fire door, both doors shall be capable of independent operation remotely – if required, and from both sides of each door.

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

- .1 the doors shall be self-closing and be capable of closing with an angle of inclination of up to 3.5° opposing closure;
- .2 approximate time of closure for hinged fire doors shall not be more than 40 s and no less than 10 s from the beginning of their movement with the ship in upright position. The approximate uniform rate of closure for sliding doors shall be of no more than 0.2 m/s and no less than 0.1 m/s with the ship in upright position;
- .3 doors which are permanently open, except those for emergency escape trunks, shall be capable of remote release from the ship safety centre/continuously manned central control station, either simultaneously or in groups and shall be capable of release also individually from a position at both sides of the door. Release switches shall have an on-off function to prevent automatic resetting of the system;
- .4 hold-back hooks not subject to central control station release from the ship safety centre/ continuously manned central control station are prohibited;
- .5 door closed remotely from the central control station shall be capable of being re-opened from both sides of the door by local control. After such local opening, the door shall automatically close again;
- .6 indication must be provided at the fire door indicator panel in the ship safety centre/continuously manned central control station whether each door is closed<sup>1</sup>;
- .7 release mechanism shall be so designed that the door will automatically close in the event of disruption of the control system or central power supply;
- .8 local power accumulators for power-operated doors shall be provided in the immediate vicinity of the doors to enable the doors to be operated after

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<sup>1</sup>) Lift door indication signals shall meet the following:

- .1 the signal showing that A Class lift doors are in the closed position shall be activated only when the order to close the main fire doors has been given by the continuously manned central control station; and
- .2 when there are several lifts giving access to the same stairway, the lift door indicators located in the continuously manned central control station shall be capable of indicating that all the lift doors giving access to the same landing are properly closed. This indication shall be shown on the panel.

- disruption of the control system or central power supply at least ten times (fully opened and closed) using the local controls;
- .9** disruption of the control system or central power supply at one door shall not impair the safe functioning of the other doors;
  - .10** remote-released sliding or power-operated doors shall be equipped with an alarm that sounds at least 5 s but no more than 10 s after the door being released from the ship safety centre/continuously manned central control station and before the door begins to move and continues sounding until the door is completely closed;
  - .11** a door designed to re-open upon contacting an object in its path shall re-open not more than 1 m from the point of contact;
  - .12** double-leaf doors equipped with a latch necessary for their fire integrity shall have a latch that is automatically activated by the operation of the doors when released by the system;
  - .13** doors giving direct access to special category spaces which are power-operated and automatically closed need not be equipped with the alarms and remote-release mechanisms required in sub-paragraphs .3 and .10.
  - .14** components of the local control system shall be accessible for maintenance and adjusting; and
  - .15** power-operated doors shall be provided with a control system of an approved type which shall be able to operate in case of fire and be in accordance with the *FTP Code*. This system shall satisfy the following requirements:
    - .1** control system shall be able to operate the door at the temperature of at least 200 °C for at least 60 min, served by the power supply;
    - .2** power supply for all other doors not subject to fire shall not be impaired;
    - .3** at temperatures exceeding 200 °C the control system shall be automatically isolated from the power supply and shall be capable of keeping the door closed up to at least 945 °C.
  - .16** remote closure panels and door closure indicator shall be located in the ship safety centre/ continuously manned central control station – see 6.1.25.2.4.

**6.1.8.4** In ships carrying not more than 36 passengers, where a space is protected by an automatic sprinkler system, complying with the requirements specified in sub-chapter 3.3, or is fitted with a continuous B Class ceiling, openings in decks not forming steps in the main vertical zones nor bounding horizontal zones shall be closed reasonably tight and such decks shall meet A Class integrity requirements in so far as is reasonable and practicable in the opinion of PRS.

**6.1.8.5** The requirements for A Class integrity of the outer boundaries of a ship shall not apply to glass partitions, windows and sidescuttles, provided that there is no requirement for such boundaries to have A Class integrity in paragraph 6.1.10.3. The requirements for A Class integrity of the outer boundaries of the ship shall not

apply to exterior doors, except for those in superstructures and deckhouses facing lifesaving appliances, embarkation and external assembly station areas, external stairs and open decks used for escape routes.

Stairway enclosure doors need not meet this requirement.

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

The self-closing hose port shall be a 150 mm square clear opening with the door closed and shall be inset into the lower edge of the door, opposite the door hinges or, in the case of sliding doors, nearest the opening.

The hose port installed in either hinged doors or slide doors need not open/close when the doors are in the closed position.

**6.1.8.7** Doors installed in boundaries of the machinery spaces, other than watertight doors, shall be so arranged that positive closure is assured in case of fire in the space by power-operated closing arrangements or by the provision of self-closing doors capable of closing against inclination of  $3.5^\circ$  opposing closure, and having a fail-safe hold-back arrangement, provided with a remotely operated release device. Doors for emergency escape trunks need not be fitted with a fail-safe hold-back facility and a remotely operated release device.

### **6.1.9 Means of Closing of Openings in Class B Fire Divisions**

**6.1.9.1** Doors and door frames in B Class divisions and means of securing them shall provide a method of closure which shall have resistance to fire equivalent to that of the divisions, this being determined in accordance with the *FTP Code*, Annex 1, Part 3, except that ventilation openings may be permitted in the lower portion of such doors. Where such opening is in or under a door, the total net area of any such opening or openings shall not exceed  $0.05 \text{ m}^2$ .

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  $0.05 \text{ m}^2$ . All ventilation openings shall be fitted with a grill made of non-combustible material. Doors shall be non-combustible.

Doors approved as B class without the sill being part of the frame shall be so installed that the gap under the door does not exceed 25 mm.

**6.1.9.2** Cabin doors in B Class divisions shall be of a self-closing type. Hold-back hooks are not permitted.

**6.1.9.3** The requirements for B Class integrity of the outer boundaries of a ship shall not apply to glass partitions, windows and sidescuttles. Similarly, the

requirements for B Class integrity shall not apply to exterior doors in superstructures and deckhouses.

For ships carrying not more than 36 passengers, the use of combustible materials in doors separating cabins from the individual interior sanitary spaces such as showers is permitted.

**6.1.9.4** In ships carrying not more than 36 passengers, where an automatic sprinkler system complying with the requirements specified in sub-chapter 3.3 is fitted:

- .1 openings in decks not forming steps in main vertical zones nor bounding horizontal zones shall be closed reasonably tight and such decks shall meet B Class integrity requirements in so far as is reasonable and practicable in the opinion of PRS;
- .2 openings in corridor bulkheads of B Class materials shall be protected in accordance with the requirements specified in sub-chapter 6.1.3.

### **6.1.10 Windows and Sidescuttles**

**6.1.10.1** Windows and sidescuttles in bulkheads within accommodation and service spaces and control stations other than those to which the requirements specified in paragraphs 6.1.8.5 and 6.1.9.3 apply, shall be so constructed as to preserve the integrity requirements of the type of bulkheads in which they are fitted, this being determined in accordance with the *FTP Code*, Annex 1, Part 3.

**6.1.10.2** Notwithstanding the requirements specified in Tables 6.1.4-1 and 6.1.4-2 as well as 6.1.5-1 and 6.1.5-2, windows and sidescuttles in bulkheads separating accommodation and service spaces and control stations from weather shall be constructed with frames of steel or other suitable material. The glass shall be retained by a metal glazing bead or angle.

**6.1.10.3** Windows facing life-saving appliances, embarkation and assembly stations, external stairs and open decks used for escape routes, as well as windows situated below liferaft and escape slide embarkation areas shall have the fire integrity in accordance with the requirements specified in Table 6.1.4-1. Where automatic sprinkler system is provided for the protection of windows, A-0 windows may be accepted as equivalent. To be considered under this paragraph, the heads of the automatic sprinkler system shall either be:

- .1 dedicated heads located above the windows, and installed in addition to the conventional ceiling sprinklers; or
- .2 conventional ceiling sprinkler heads so arranged that the window is protected by an average application rate of at least 5 l/min per 1 m<sup>2</sup> and the additional window area is included in the calculation of the area covered by the automatic sprinkler system; or
- .3 heads of the equivalent high pressure sprinkler system tested and approved in accordance with the guidelines specified in Res. A.800(19).



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

### **6.1.11 Fire-extinguishing Arrangements in Control Stations, Accommodation and Service Spaces**

**6.1.11.1** In passenger ships carrying not more than 36 passengers, there shall be installed throughout accommodation and service spaces, as well as control stations except for the spaces which afford no substantial fire risk (e.g. voids, public toilets, etc.) either:

- .1** fixed fire detection and fire alarm system, of approved type, complying with the requirements specified in 4.1 and 6.1.14 so installed and arranged as to detect the presence of fire in all above-mentioned spaces and provide smoke detection in corridors, stairways and escape routes within the accommodation spaces; or
- .2** automatic sprinkler system, of approved type, complying with the requirements specified in 3.3 and 6.1.13, and additionally fire detection and fire alarm, complying with the requirements specified in 4.1 and 6.1.14, which will be so installed and arranged as to provide smoke detection in corridors, stairways and escape routes within the accommodation spaces.

If fixed fire detection and fire alarm system is installed only in corridors, stairways and escape routes within accommodation area, an automatic sprinkler system shall be fitted in all accommodation spaces, service spaces and control stations.

**6.1.11.2** In passenger ships carrying more than 36 passengers, there shall be installed throughout accommodation and service spaces, as well as control stations including corridors and stairways:

- .1** automatic sprinkler system, of approved type, complying with the requirements specified in 3.3 and 6.1.13. Alternatively, control stations – where water may cause damage to essential equipment – may be fitted with a fixed fire-extinguishing system of approved type; and
- .2** fixed fire detection and fire alarm system of approved type, complying with the requirements specified in 4.1 and 6.1.14 so installed and arranged as to provide smoke detection in those spaces; smoke detectors, however, need not be fitted in private bathrooms and galleys.

Each enclosed space of the floor area greater than 2 m<sup>2</sup> shall be provided with a sprinkler and smoke detector. In spaces having the floor area smaller than 2 m<sup>2</sup> only smoke detector may be fitted.

Spaces of low fire risk (such as e.g. voids, toilets, carbon dioxide rooms and similar spaces) need not be fitted with an automatic sprinkler system and smoke detector.

In refrigerated chambers and in other spaces where steam or fumes may occur, such as saunas and laundries, heat detectors may be installed instead of smoke detectors.

**6.1.11.3** In passenger ships, furniture and furnishings on passenger cabin balconies shall be protected by a fixed water-spraying and fixed fire detection and fire alarm systems unless the furniture and furnishings fulfil the requirements for the spaces of restricted fire risk in accordance with the definitions given in 1.2.57 – see 6.1.1.2.8.

Fixed fire detection and fire alarm systems for cabin balconies shall be designed, arranged and type-tested in accordance with the guidelines contained in MSC.1/Circ.1242, whereas the water-spraying fire-extinguishing system – see sub-chapter 3.4.5 (MSC.1/Circ.1268).

**6.1.11.4** The entire main vertical zone containing the atrium shall be protected throughout with a smoke detection system complying with the requirements specified in 4.1 and 6.1.14, including smoke detectors.

**6.1.11.5** Atriums shall be provided with the smoke control and ventilation system automatically activated by the fire detection and fire alarm system in accordance with the requirements specified in sub-chapter 22.3.5, *Part VI – Machinery Installations and Refrigerating Plants*. The control panel of the smoke control and ventilation system shall be located in the ship safety centre – see 6.1.25.2.4.

**6.1.11.6** Passenger internal assembly stations shall be fitted with a supply ventilation system in accordance with the requirements specified in sub-chapter 22.3.6, *Part VI – Machinery Installations and Refrigerating Plants*.

**6.1.11.7** Accommodation spaces shall be equipped with fire-fighting equipment and emergency escape breathing devices arranged in accordance with the requirements specified in Table 5.1.6-1.

## **6.1.12 Fire-Extinguishing Arrangements in Cargo Spaces**

**6.1.12.1** Cargo spaces of passenger ships of 1000 gross tonnage and above shall be protected by a fixed carbon dioxide fire-extinguishing system complying with the requirements specified in 3.6 or an equivalent gas fire-extinguishing system, referred to in 3.7, or a fixed high-expansion foam fire-extinguishing system, complying with the requirements of 3.5.3, which gives equivalent protection for the carried cargoes.

**6.1.12.2** In passenger ships of less than 1000 gross tonnage and in passenger ships of restricted service (see 6.17.1), a fixed gas fire-extinguishing system in cargo spaces may be waived, provided that the ship is fitted with steel hatch covers and effective means of closing all ventilators and other openings leading to the cargo spaces.

**6.1.12.3** A fixed fire detection and fire alarm system complying with the requirements of 4.1 or a sample extraction smoke detection system complying with

the requirements of 4.2 shall be provided in any cargo space which is not accessible during the ship's normal operation.

In passenger ships of restricted service, fire detection system and fire alarm system need not be installed – see 6.17.2.

**6.1.12.4** In all passenger ships, regardless of the gross tonnage, carrying dangerous cargo on deck or in cargo spaces, each cargo space shall be provided with the fixed carbon-dioxide fire-extinguishing system, complying with the requirements specified in 3.6 or a gas fire-extinguishing system which gives equivalent protection for the carried cargoes.

### **6.1.13 Automatic Sprinkler System**

**6.1.13.1** In addition to the requirements specified in this sub-chapter, an automatic sprinkler system shall fulfil the requirements specified in 3.3.

**6.1.13.2** There shall be not less than two sources of power supply for the sea water pump and alarm and detection system. Where the sources of power for the pump are electrical, these shall be a main generator and an emergency source of power.

**6.1.13.3** Any section of sprinklers shall not be situated in more than one main vertical zone and shall not serve more than two decks. Exemption from this requirement is subject to PRS' consent in each particular case.

**6.1.13.4** The control panel of the automatic sprinkler system shall be located in the ship safety centre/central control station.

**6.1.13.5** Electric power supply for the automatic sprinkler system shall fulfil the requirements specified in sub-chapter 22.1.1, *Part VIII – Electrical Installations and Control Systems*.

### **6.1.14 Fire Detection and Alarm System**

**6.1.14.1** In addition to the requirements set forth in 4.1, fire detection and alarm system shall comply with the requirements of the present sub-chapter.

**6.1.14.2** Fire detection and alarm system shall be capable of remote identification of each detector and manually operated call point individually.

**6.1.14.3** Fire detectors fitted in cabins, when activated, shall be capable of emitting, or cause to be emitted, an audible alarm within the space in which they are located.

**6.1.14.4** On cabin balconies, the fixed fire detection and fire alarm system shall, as a minimum, have section identification capability.

**6.1.14.5** The emergency source of power, specified in 4.1.3.1, shall be sufficient to maintain the operation of the fire detection and fire alarm system for the periods required in sub-chapter 22.1.2, *Part VIII – Electrical Installations and Control Systems*, and at the end of that period shall be capable of operating all the connected visual and audible fire alarm signals for a period of at least 30 min.

**6.1.14.6** Cables routed through other main vertical zones that they serve, and cables to control panels in an unattended fire control stations shall be fire-resisting according to IEC 60331, unless duplicated and well separated.

**6.1.14.7** Any section of detectors and manually operated call points shall not be situated in more than one main vertical zone, except on cabin balconies.

**6.1.14.8** The control panel of the fixed fire detection and fire alarm system shall be designed on the fail-safe principle (e.g. an open detector circuit shall cause an alarm condition).

**6.1.14.9** The control panel of the fixed fire detection and fire alarm system shall be located in the ship safety centre/central control station.

**6.1.14.10** Indicating unit that is capable of individually identifying each detector that has been activated or manually operated call point that has operated shall be located on the navigation bridge. On cabin balconies, indicating units shall, as a minimum, denote the section in which a detector has activated or manually operated call point has been operated.

### **6.1.15 Signalling System in Ships Carrying more than 36 Passengers**

**6.1.15.1** Signalling system for the fire detection and automatic sprinkler systems shall be located in the ship safety centre/ continuously manned central control station. Additionally, the following shall be provided in those locations:

- .1** control panels for remote closing the fire doors;
- .2** controls for switching and shutting down the ventilation fans;
- .3** indicators of open or closed position of the fire doors;
- .4** indicators of fan operation;
- .5** indicators of operation or off status of fire detectors and alarms.

**6.1.15.2** The power supply and the signalling system shall fulfil the requirements specified in sub-chapter 22.1.1, *Part VIII – Electrical Installations and Control Systems*.

### **6.1.16 Water Fire Main System**

**6.1.16.1** The water fire main system shall comply with the applicable requirements specified in 3.2, as well the requirements of the present sub-chapter.

**6.1.16.2** The number of the main fire pumps and the pressure of water delivered simultaneously by two pumps through the required nozzles, at the discharge rate specified in 6.1.16.4, at any hydrant, shall be at least equal to the values specified in Table 6.1.16.2.

**Table 6.1.16.2**

Ship gross tonnage	Number of pumps	Minimum pressure at hydrants [MPa]
< 4000	2	0.3
≥ 4000	3	0.4

**6.1.16.3** The total capacity of the main fire pumps, at the pressure not lower than that specified in Table 6.1.16.2, shall not be less than two-thirds of the required combined capacity of bilge pumps whose capacity shall be determined in accordance with the requirements specified in paragraphs 6.1.3 and 22.3.2.1, *Part VI – Machinery Installations and Refrigerating Plants*.

**6.1.16.4** Where more pumps than the minimum of the required pumps are installed, such additional pumps shall have a capacity of at least 25 m<sup>3</sup>/h and shall be capable of delivering at least two required jets of water.

**6.1.16.5** In ships of 1000 gross tonnage and upwards, the arrangement of fire pumps, their sources of power and sea connections shall be such that in the event of fire in any one compartment all the fire pumps will not be put out of action.

It means that at least one of the pumps shall be supplied from the main and emergency source of power and shall be located in a separate space. Cabling for the emergency source of power shall not be led through machinery spaces of category A, galleys or other spaces of high fire risk.

Where fire pumps are installed in adjacent spaces, the division between the spaces shall be of A-60 Class.

**6.1.16.6** In passenger ships of less than 1000 gross tonnage, if a fire in any one compartment could put the required two pumps out of action (e.g. when the pumps are located in one compartment), an emergency fire pump complying with the requirements specified in sub-chapter 3.2.4, but with the capacity not less than 25 m<sup>3</sup>/h, shall be provided.

**6.1.16.7** In passenger ships of 1000 gross tonnage and upwards, the water fire main system shall be kept permanently pressurised and shall be such as to ensure an effective jet of water immediately available from any hydrant in an interior location and to ensure the continuation of the output of water jet by automatic starting of one required fire pump.

**6.1.16.8** In passenger ships of less than 1000 gross tonnage, immediate availability of water supply shall be achieved either by automatic start of at least one fire pump or by remote starting from the navigation bridge of at least one fire pump.

**6.1.16.9** Fire pumps and the emergency fire pumps start buttons, as well as the indicators of the pumps operation shall be located in the ship safety centre/continuously manned central control station – see 6.1.25.2.4.17.

**6.1.16.10** In accommodation, service and machinery spaces, the number and position of hydrants shall be such that the requirements specified in 3.2.6.3 may be fulfilled when all watertight doors and all doors in the main vertical zone bulkheads are closed.

**6.1.16.11** In passenger ships where access is provided to a machinery space of category A at a low level from an adjacent shaft tunnel, two fire hydrants shall be provided external to but near the entrance to that machinery space of category A. This requirement also applies to other spaces adjacent to the machinery space of category A, although it need not be fulfilled where the tunnel or adjacent spaces are not part of the escape route.

The fire hydrants shall be supplied by the pipeline which does not pass through machinery space of category A.

**6.1.16.12** In interior locations in passenger ships carrying more than 36 passengers, fire hoses shall be connected to the hydrants at all times.

**6.1.16.13** In all passenger ships, the number of fire hoses shall be such that there will be at least one fire hose for each of the fire hydrants.

### **6.1.17 Fire Protection of Exhaust Ventilation Ducts from Galley Range**

**6.1.17.1** In ships carrying not more than 36 passengers, the exhaust duct from a galley range shall fulfil the requirements specified in 2.7.1.

**6.1.17.2** In ships carrying more than 36 passengers, each exhaust duct from a galley range installed in a galley (irrespective of whether or not it passes through accommodation spaces) shall comply with the requirements specified in 2.7.1 and additionally shall be provided with:

- .1** automatically and remotely operated fire dampers located in the lower end of the duct at the junction between the duct and the galley range hood;
- .2** remotely operated fire damper, located in the upper end of the duct in a position close to the outlet of the duct. Where the exhaust duct has branches below the upper fire damper, each branch shall be fitted with a remotely operated fire damper;
- .3** suitably located hatches for inspection and cleaning. One hatch shall be provided close to the exhaust fan. A hatch for inspection and cleaning shall

also be fitted in the lower end of the galley exhaust duct, where the grease can accumulate.

Remotely controlled arrangements for shutting off the exhaust and supply fans serving the galley, for operating the fire dampers (including the fire dampers in each branch), as well as for operating the fire-extinguishing system shall be located outside the galley, in a position close to the entrance to the galley.

**6.1.17.3** In ships carrying more than 36 passengers, the exhaust duct from a galley range installed on open decks shall comply with the requirements specified in 6.1.17.2 when passing through accommodation spaces or spaces containing combustible materials.

### **6.1.18 Fire-Extinguishing Arrangements in Machinery Spaces**

**6.1.18.1** In all passenger ships, machinery spaces of category A shall be fitted with fixed total flooding fire-extinguishing system, required in 2.5.1.1.

**6.1.18.2** In passenger ships of 500 gross tonnage and upwards, machinery spaces of category A above 500 m<sup>3</sup> in volume, in addition to the fixed total flooding fire-extinguishing system shall be protected by a local water-based system or an equivalent system complying with the requirements specified in 3.4.6.

System activation alarm signals shall be located in the ship safety centre/continuously manned central control station - see 6.1.25.2.4.11.

**6.1.18.3** In ships carrying more than 36 passengers, each machinery space of category A shall be provided with two water fog applicators.

### **6.1.19 Carbon Dioxide Fire-Extinguishing System**

The piping of each fixed carbon dioxide system used on ship shall be such that 85% of the required gas quantity may be discharged into each protected space within 2 min.

### **6.1.20 Fire-Fighter's Outfit**

**6.1.20.1** In passenger ships, if the aggregate of the lengths of all passenger spaces and service spaces on the deck which carries such spaces is more than 80 metres, or, if there is more than one such deck, on the deck which has the largest aggregate of such lengths, two fire-fighter's outfits and two sets of personal equipment for every 80 metres, or part thereof, of such aggregate of lengths shall be additionally provided.

In passenger ships carrying more than 36 passengers, two additional fire-fighter's outfits shall be provided for each main vertical zone. However, for stairway enclosures which constitute individual main vertical zones and for the main vertical zones in the fore or aft end of a ship which do not contain spaces of categories (6), (7), (8) or (12) defined in 6.1.4, no additional fire-fighter's outfits are required.

**6.1.20.2** In ships carrying more than 36 passengers, for each pair of breathing apparatus there shall be provided one water fog applicator which shall be stored adjacent to such apparatus.

**6.1.20.3** In all passenger ships, at least two fire-fighter's outfits and, in addition, one set of personal equipment shall be available at any one position. At least two fire-fighter's outfits shall be stored in each main vertical zone.

**6.1.20.4** In ships carrying more than 36 passengers, two spare charges for each breathing apparatus shall be provided, irrespective of fitting the ship with the means for fully recharging the air cylinders.

Ships carrying not more than 36 passengers provided with the means for fully recharging the air cylinders may be provided with only one spare charge for each breathing apparatus.

**6.1.20.5** Passenger ships carrying more than 36 passengers shall be fitted with a suitably located means for fully recharging breathing air cylinders, free from contamination. The means for recharging shall be either:

- .1 breathing air compressors supplied from the main and emergency switchboard, or independently driven, with a minimum capacity of 60 l/min per required breathing apparatus, not to exceed 420 l/min; or
- .2 self-contained high-pressure storage systems of suitable pressure to recharge the breathing apparatus used on board, with a capacity of at least 1200 l per required breathing apparatus, not to exceed 50000 l of free air.

### **6.1.21 Fire Control Plan**

**6.1.21.1** *Fire Control Plan*, referred to in 1.4.2, is required on each passenger ship, irrespective of its gross tonnage.

**6.1.21.2** For passenger ships carrying more than 36 passengers, *Fire Control Plan* shall additionally contain the following information: date on which the keel was laid, date and scope of the ship modifications, as well as the applied additionally safety measures in accordance with the guidelines given in Res.A.756(18).

### **6.1.22 Fire Protection of Exhaust Duct from Main Laundry (Chemical Laundry)**

In ships carrying more than 36 passengers, the exhaust duct from the main laundry shall be fitted with:

- .1 filter(s) readily removable for cleaning purposes;
- .2 automatically and remotely operated fire damper located in the lower end of the duct;
- .3 suitably located hatches for inspection and cleaning.

The main laundry shall be provided with remote control arrangements for shutting off the exhaust duct fans and supply fans from within the space and for operating the fire damper, referred to in .2.



### **6.1.23 Requirements for Large Passenger Ships in the Context of Fire Casualties – after a Fire Casualty that does not Exceed the Casualty Threshold**

#### **6.1.23.1 Application**

**6.1.23.1.1** The requirements of sub-chapter 6.1.23 apply to passenger ships constructed on or after 1 July 2010 having the length <sup>1)</sup> of 120 m or more or having three or more main vertical zones.

**6.1.23.1.2** Sub-chapter 6.1.23 specifies the design criteria for a ship's safe return to a port of refuge under its own propulsion after a fire casualty that does not exceed the casualty threshold specified in 6.1.23.2 and provides also functional requirements and performance standards for safe areas.

**6.1.23.1.3** Interpretations regarding the requirements specified in the present sub-chapter are given in Appendix to MSC.1/Circ.1369.

#### **6.1.23.2 Fire Casualty Threshold**

The casualty threshold, in the context of a fire, includes:

- .1** loss of a space of origin up to the nearest A Class boundaries, which are a part of the space of origin, if the space of origin is protected by a fixed fire-extinguishing system; or
- .2** loss of the space of origin and adjacent spaces up to the nearest A Class boundaries, which are not part of the space of origin.

#### **6.1.23.3 Safe Return to a Port of Refuge**

**6.1.23.3.1** When fire damage does not exceed the casualty threshold specified in 6.1.23.2, the ship shall be capable of returning to a port of refuge while providing safe area(s) as defined in 1.2.69. To be deemed capable of returning to a port of refuge, the following systems/arrangements shall remain operational in the remaining part of the ship not affected by fire:

- .1** propulsion;
- .2** steering systems and steering-control systems;
- .3** navigational systems;
- .4** systems for filling, transfer and service of fuel oil;
- .5** systems of internal communication between the navigation bridge, machinery spaces, safety centre, fire-fighting and damage control teams, as well as communication systems required for passenger and crew notification and mustering;
- .6** means of external communication;
- .7** water fire main system;

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<sup>1)</sup> See the definitions of the ship's length (*L*) given in *Part II – Hull*.

- .8 fixed fire-extinguishing systems;
- .9 fire detection and fire alarm system;
- .10 bilge and ballast systems;
- .11 power-operated watertight and semi-watertight doors;
- .12 systems intended to support safe areas, specified in 6.1.23.4.1.2;
- .13 flooding detection systems; and
- .14 other systems determined to be vital to damage control efforts.

**6.1.23.3.2** Interpretations relating to pipings, ventilation ducts, electric cables, systems for filling, transfer and service of fuel oil, as well as means of external communication are given in Annex to MSC.1/Circ.1437.

#### **6.1.23.4 Safe Area(s)**

##### **6.1.23.4.1 Functional Requirements**

- .1 the safe area(s) shall generally be internal space(s). However, the use of an external space as a safe area may be allowed in ships operating in restricted area of navigation and in relevant expected environmental conditions;
- .2 the safe area(s) shall provide all ship occupants (passengers and crew) with the basic services to ensure that their health is maintained. These basic services include:
  - .1 sanitation;
  - .2 water;
  - .3 food;
  - .4 alternate space for medical care;
  - .5 shelter from the weather;
  - .6 means of preventing heat stress and hypothermia;
  - .7 light; and
  - .8 ventilation;
- .3 ventilation system shall reduce the risk that smoke and hot gases could affect the use of the safe area(s); and
- .4 means of access to life-saving appliances shall be provided from each area identified or used as a safe area, taking into account that a main vertical zone may not be available for internal transit.

##### **6.1.23.4.2 Alternate Space for Medical Care**

Alternate space for medical care shall comply with the requirements specified in MSC/Circ. 1129.

## **6.1.24 Requirements for Large Passenger Ships in the Context of Fire Casualties – if the Casualty Threshold is Exceeded**

### **6.1.24.1 Application**

**6.1.24.1.1** The requirements of sub-chapter 6.1.24 apply to passenger ships having the length  $L^{1)}$  of 120 m or more or having three or more main vertical zones.

**6.1.24.1.2** Sub-chapter 6.1.24 provides the basic criteria for systems required to remain operational for supporting the orderly evacuation and abandonment of a ship if the casualty threshold, as defined in 6.1.23.2, is exceeded.

**6.1.24.1.3** Interpretations regarding the requirements set forth in the present sub-chapter are given in the Appendix to MSC.1/Circ. 1369.

### **6.1.24.2 Requirements for Systems that Shall Remain Operational if the Casualty Threshold is Exceeded**

**6.1.24.2.1** In the case when one main vertical zone is unserviceable due to fire, the following systems shall be so arranged and segregated as to remain operational:

- .1 water fire main system;
- .2 internal communication systems (in support of fire-fighting teams, for passenger and crew notification and mustering);
- .3 means of external communication;
- .4 bilge systems for removal of fire-fighting water;
- .5 lighting along escape routes, at assembly stations and at embarkation stations of life-saving appliances; and
- .6 the systems of marking escape routes or alternative evacuation guidance systems.

**6.1.24.2.2** The above systems shall be capable of operation for at least 3h (from the moment the casualty threshold has been exceeded) on the assumption of no damage outside the unserviceable main vertical zone. These systems are not required to remain operational within the unserviceable main vertical zone.

**6.1.24.2.3** Cables and piping for the systems, referred to in 6.1.24.2.1, passing through the unserviceable main vertical zone shall be run within a trunk constructed to A-60 Class standard. An equivalent degree of protection for the above-mentioned cables and piping may be allowed subject to agreement with PRS.

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<sup>1)</sup> See the definitions of the ship's length ( $L$ ) given in *Part II – Hull*.

## **6.1.25 Safety Centre**

### **6.1.25.1 Application**

**6.1.25.1.1** Every passenger ship shall have on board a safety centre to assist with the management of emergency situations, complying with the requirements of the present sub-chapter.

**6.1.25.1.2** Clarifications regarding interrelation between the central control station, navigation bridge and safety centre are given in MSC.1/Circ.1368.

### **6.1.25.2 Requirements for Safety Centre**

**6.1.25.2.1** The safety centre shall either be a part of the navigation bridge or be located in a separate space adjacent to and having direct access to the navigation bridge so that the management of emergencies can be performed without distracting watch officers from their navigational duties.

**6.1.25.2.2** The layout and ergonomic design of the safety centre shall take into account the guidelines developed by IMO (MSC.1/Circ. 1368).

**6.1.25.2.3** Means of communication between the safety centre, the central control station, the navigation bridge, the engine control room, the storage rooms (stations) for fire fire-extinguishing systems and fire equipment lockers shall be provided.

**6.1.25.2.4** The full functionality (operation, control, monitoring or any combination thereof, as required) of the safety systems shall be available from the safety centre:

- .1** all power ventilation systems;
- .2** fire doors;
- .3** general alarm system;
- .4** public address system;
- .5** electrically powered escape routes low-location lighting systems or evacuation guidance systems;
- .6** watertight and semi-watertight doors;
- .7** indicators (open-closed) for shell doors, loading doors and other closing appliances;
- .8** water leakage of inner/outer bow doors, stern doors and any other shell doors;
- .9** television surveillance system;
- .10** fire detection and fire alarm system;
- .11** fixed local fire-extinguishing systems;
- .12** automatic sprinkler systems and equivalent systems;
- .13** water-based fire-extinguishing systems for machinery spaces;
- .14** alarm to summon the crew;

- .15 atrium smoke distraction systems;
- .16 flooding detection systems;
- .17 fire pumps and emergency fire pumps.

## **6.2 Ferries and Ro-Ro Ships – Marks: FERRY, RO-RO SHIP**

### **6.2.1 Means of Escape from Ro-Ro Spaces**

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

**6.2.1.2** Escape and access routes shall be so arranged as to ensure safe escape routes during loading and unloading such as solid-line indication of an escape lane, with minimum clearance of 600 mm in width.

### **6.2.2 Fire Protection Arrangements in Ro-Ro Cargo Spaces and Vehicle Spaces**

#### **6.2.2.1 Fire Detection and Fire Alarm System**

**6.2.2.1.1** Ro-ro cargo spaces and vehicle spaces shall be fitted with a fixed fire detection and fire alarm system in accordance with the requirements specified in 4.1. The system shall be capable of rapidly detecting the onset of fire. The type of detectors and their spacing shall be in accordance with PRS requirements taking into account the effects of ventilation and other relevant factors. After being installed, the system shall be tested under normal ventilation conditions and shall give an overall response in accordance with PRS requirements.

**6.2.2.1.2** Smoke detector sections in ro-ro cargo spaces and vehicle spaces may be provided with a timer for disconnecting the detector sections during loading and unloading to avoid false alarms. The time of disconnection shall be adapted to the time of loading/unloading. The control panel shall indicate whether the detector sections are disconnected or not.

If, however, the manually operated call points have been installed, they shall not be capable of being disconnected during loading and unloading of vehicles.

**6.2.2.1.3** Except open ro-ro spaces, open vehicle spaces, a sample extraction smoke detection system complying with the requirements specified in 4.2 may be applied instead of fixed detection and alarm system.

#### **6.2.2.2 Fixed Fire-Extinguishing Systems**

**6.2.2.2.1** Vehicle spaces and ro-ro spaces which are capable of being sealed from a location outside of the cargo spaces shall be fitted with one of the fixed fire-extinguishing systems:

- .1 gas fire-extinguishing system in accordance with the requirements specified in 3.6;
- .2 a fixed high-expansion foam fire-extinguishing system in accordance with the requirements specified in 3.5.3;
- .3 a fixed pressure water-spraying system in accordance with the requirements specified in 3.4.2;
- .4 an equivalent high-pressure water-spraying system in accordance with the requirements specified in 3.4.3.

**6.2.2.2.2** Ro-ro spaces and vehicle spaces not capable of being sealed shall be fitted with a fixed pressure water-spraying system in accordance with the requirements, specified in sub-chapter 3.4.2, for manual operation which shall protect all parts of any deck and vehicle platform. Such water-spraying system shall have:

- .1 a pressure gauge on the valve manifold;
- .2 clear marking on each manifold valve indicating the spaces/pipe section served;
- .3 instructions for maintenance and operation located in the valve manifold room;
- .4 a sufficient number of drainage valves.

**6.2.2.2.3** When fixed pressure water-spraying systems are provided, in view of the serious loss of stability which might arise due to large quantities of water accumulating on the deck or decks during the operation of the fixed pressure water-spraying system, proper arrangements shall be made to drain the space in accordance with the requirements specified in sub-chapter 6.12, *Part VI – Machinery Installations and Refrigerating Systems*.

### **6.2.2.3 Number and Position of Hydrants**

The arrangement of hydrants shall be such that at least two jets of water not emanating from the same hydrant, one of which shall be from a single length of hose, may reach any part of any cargo space when empty, any ro-ro space or any vehicle space, in which latter case the two jets of water shall reach any part of the space, each from a single length of hose. Furthermore, such hydrants shall be positioned near accesses to the protected space.

### **6.2.2.4 Ventilation**

Ventilation in closed ro-ro spaces and closed vehicle spaces shall fulfil the requirements specified in sub-chapter 11.4, *Part VI – Machinery Installations and Refrigerating Plants*.

In cargo ships, ventilation fans shall normally be run continuously whenever vehicles are on board. Where there is a possibility of shutting off fans during voyage (only in cargo ships), the vehicle space shall be proved combustible gas-

free well in advance prior to vehicle discharge. One or more portable combustible gas detecting instruments shall be carried for this purpose.

#### **6.2.2.5 Sources of Ignition**

Electrical equipment and wiring in closed ro-ro cargo spaces and vehicle spaces which may be the source of ignition shall be explosion-proof and shall fulfil the relevant requirements specified in sub-chapter 22.3, *Part VIII – Electrical Installations and Control Systems*.

Other equipment which may constitute a source of ignition of flammable vapours is not permitted in closed ro-ro cargo spaces and vehicle spaces.

NO SMOKING signs shall be placed on all entrance doors to ro-ro spaces and vehicle spaces.

#### **6.2.2.6 Scuppers and Discharges**

Scuppers from closed ro-ro cargo spaces and vehicle spaces shall not be led to machinery or other spaces where sources of ignition may be present.

Scuppers and discharges shall fulfil the requirements specified in sub-chapter 6.12, *Part VI – Machinery Installations and Refrigerating Plants*.

#### **6.2.2.7 Permanent Openings**

Permanent openings in the side plating, the ends or deckhead of the space shall be so situated that a fire in the cargo space does not endanger stowage areas and embarkation stations for survival craft and accommodation spaces, service spaces and control stations in superstructures and deckhouses above the cargo spaces.

#### **6.2.2.8 Portable Fire-Extinguishers**

**6.2.2.8.1** Portable fire-extinguishers shall 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 fire-extinguisher shall be located at each access to such a cargo space.

Portable fire-extinguishers are not required for weather decks used as cargo ro-ro spaces.

**6.2.2.8.2** Each ro-ro and vehicle space intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion shall be additionally provided with the following fire-extinguishing appliances:

- .1** at least three water-fog applicators; and
- .2** one portable foam applicator unit in accordance with the requirements specified in 5.1.3, provided that at least two such units are available in the ship for use in such spaces.

**6.2.2.8.3** Cargo holds, loaded with vehicles with fuel in their tanks and stowed in open or closed containers need not be provided with the portable fire-extinguishers, water fog applicators and foam applicator unit.

### **6.2.3 Fire Protection of Open Deck**

Open vehicle spaces need not be provided with fire detection and alarm system, fixed water-spraying fire-extinguishing system, portable foam applicator units and portable fire-extinguishers.

## **6.3 Tankers (Crude Oil Tankers and Product Carriers) Carrying Cargoes Having a Flash-Point not exceeding 60 °C and Combination Carriers – Marks: CRUDE OIL TANKER, PRODUCT CARRIER A, CRUDE OIL TANKER/ORE CARRIER, CRUDE OIL TANKER/ORE CARRIER/BULK CARRIER**

### **6.3.1 Application**

The requirements specified in sub-chapter 6.3 apply to tankers carrying crude oil or petroleum products having a flash-point not exceeding 60 °C (closed cup test), as determined by an approved flash-point apparatus, and a Reid vapour pressure which is below atmospheric pressure or other liquid products of similar fire-hazard, as well as to combination carriers intended for the alternate carriage of the above-mentioned liquid cargoes.

### **6.3.2 Location and Separation of Spaces**

Ship spaces shall be so arranged or separated, e.g. by cofferdams, as to preclude the cargo or its vapour from penetration to the spaces/zones where there is a risk of explosion.

Cofferdam means an isolating space (where there is a risk of explosion) between two adjacent steel bulkheads or decks which ensures safe access and inspection<sup>1)</sup>. In the case when a corner-to-corner situation occurs, this principle may be applied by welding a diagonal plate across the corner<sup>2)</sup>.

Void space or ballast water tank protecting fuel oil tank need not be considered as "cargo area", defined in 1.2.70, even though they have a cruciform contact with the cargo oil tank or slop tank.

Void spaces protecting fuel oil tanks are not considered as a cofferdam even though they have a cruciform contact with the slop tank.

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<sup>1)</sup> No cargo, wastes or other goods shall be located in cofferdams.

<sup>2)</sup> The example of such isolating plates - see Appendix to MSC/Circ.1120, interpretations of SOLAS regulation II-2/4.5.1.



### 6.3.2.1 Machinery Spaces

**6.3.2.1.1** Cargo pump-rooms, cargo tanks, slop tanks and cofferdams shall be positioned forward of machinery spaces. Cargo tanks and slop tanks shall be isolated from machinery spaces by cofferdams, cargo pump-rooms, oil fuel bunker tanks or ballast tanks.

**6.3.2.1.2** Machinery spaces, other than those of category A, may be permitted forward of the cargo tanks and slop tanks, provided they are:

- .1** isolated from the cargo tanks and slop tanks by cofferdams, cargo pump-rooms, oil fuel bunker tanks or ballast tanks; and
- .2** have at least one portable fire-extinguisher. In cases where they contain internal combustion machinery, one approved mobile foam-type extinguisher of at least 45 l capacity or equivalent shall be arranged in addition to portable fire-extinguishers. If operation of a mobile fire extinguisher is impracticable, this fire-extinguisher may be replaced by two additional portable fire-extinguishers.

Where deemed necessary for the safety or navigation of the ship, machinery spaces containing internal combustion machinery not being main propulsion machinery having an output greater than 375 kW may be located forward of the cargo area, provided the arrangements are in accordance with the provisions of the present paragraph.

### 6.3.2.2 Cargo Pump-Rooms

**6.3.2.2.1** Cargo pump-rooms (where pumps of cargo such as cargo pumps, stripping pumps and pumps for crude oil washing of cargo tanks are provided) shall be positioned forward of machinery spaces.

Cargo pump-rooms shall be considered as separate spaces bounded by gas-tight divisions.

**6.3.2.2.2** 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, shall be considered as equivalent to a cargo pump-room within the context of this regulation 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 serving spaces not adjacent to cargo tanks need not fulfil the requirements for cargo pump-rooms.

**6.3.2.2.3** 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  $H$  (for  $H$  see 1.2, *Part II – Hull*) 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, PRS may permit

a recess in excess of such height, but not exceeding one-half of the moulded depth above the keel.

**6.3.2.2.4** To ensure fire safety in cargo-pump rooms during assembly, inspection and maintenance, reference is made to the guidelines set out in MSC.1/Circ.1321.

### **6.3.2.3 Accommodation Spaces, Service Spaces, Control Stations and Cargo Control Stations**

**6.3.2.3.1** Accommodation spaces, service spaces, control stations and main cargo control stations (excluding isolated cargo handling gear lockers) shall be positioned aft of 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 shall be so arranged that a single failure of a deck or bulkhead shall not permit the entry of gas or vapours from the cargo tanks into an accommodation space, main cargo control stations, control station or service spaces.

**6.3.2.3.2** Exceptionally, where deemed necessary, PRS may permit accommodation and service spaces, control stations and the main cargo control stations forward of the cargo tanks, slop tanks and spaces which isolate cargo and slop tanks from machinery spaces.

**6.3.2.3.3** Where the fitting of a navigation position above the cargo area is shown to be necessary, it shall be for navigation purposes only and it shall be separated from the cargo tank deck by means of an open space with a height of at least 2 m. Fire protection requirements for such a navigation position shall be that required for control stations on tankers, as specified in Tables 6.3.3-1 and 6.3.3-2 and other relevant paragraphs of *Part V*.

**6.3.2.3.4** In way of accommodation spaces, a smoking room shall be arranged. The room shall be protected by B-15 Class divisions, the interior finishing of the room shall be made of materials with low flame-spread characteristics and it shall be provided with sufficient ventilation.

**6.3.2.3.5** In accommodation spaces and service spaces, only *IC method*, specified in 2.2.3.1, shall be used.

### **6.3.2.4 Requirements for Combination Carriers**

In combination carriers intended for the alternate carriage of petroleum products and dry cargoes in bulk, the following requirements shall be fulfilled:

- .1** the slop tanks shall be surrounded by cofferdams, except where the boundaries of the slop tanks are formed by: the hull, the main cargo deck, cargo pump-room bulkhead or oil fuel storage tank. These cofferdams shall not be open to a double bottom, pipe tunnel, pump-room or other enclosed space nor shall they be used for cargo or ballast and shall not be connected

to piping systems serving oil cargo or ballast. Means shall 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 shall not be open to the double bottom, pipe tunnel or other enclosed space; however, openings provided with gastight bolted covers are permitted;

- .2 hatches and tank cleaning openings to slop tanks shall only be permitted on the open deck and shall be fitted with closing arrangements. Except where they consist of bolted plates with bolts at watertight spacing, these closing arrangements shall be provided with locking arrangements which prevent unauthorised opening.

### **6.3.2.5 Requirements for Exterior Boundaries of Superstructures and Cargo Deck**

**6.3.2.5.1** Permanent continuous coaming reaching from side to side, at least 300 mm in height, shall be provided on the open deck about 2 m from the front bulkhead of the superstructure containing accommodation and service spaces so that any cargo spilled on the deck could not penetrate into the accommodation and service space area.

Where stern loading station is installed on board the ship, such coaming shall be provided also at the stern bulkhead of the superstructure.

**6.3.2.5.2** Exterior boundaries of superstructures and deckhouses enclosing accommodation spaces, including any overhanging decks which support such spaces shall be constructed of steel and A-60 Class standard type for the whole length in the cargo area and on the sides for the length of 3 m aft from the end boundary of the cargo space area on every deck. The superstructure and deckhouse bulkheads which face the cargo area should be provided (at 3 m length) with A-60 Class standard insulation up to the underside of the deck of the navigation bridge.

Penetrations of pipes, cables and ventilation ducts through exterior boundaries of superstructures, which are required to be of A-60 Class standard, shall fulfil the requirements specified in 2.2.5.

**6.3.2.5.3** In boundary bulkheads of superstructures and deckhouses, access doors, air inlets and openings to accommodation spaces, service spaces, control stations and machinery spaces shall not face the cargo area. They shall 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, however, need not exceed 5 m.

Access to forecastle spaces containing sources of ignition is permitted through doors facing the cargo area, provided that such doors are located outside hazardous areas as defined in IEC Publication 60092-502.

**6.3.2.5.4** In boundary bulkheads of superstructures facing the cargo area and on the sides of superstructures at a distance less than that specified in 6.3.2.5.3, access doors to main cargo control stations and to such service spaces as provision rooms, store-rooms and lockers may be fitted, provided they do not give access to accommodation spaces, control stations and other service spaces – such as galleys, pantries or workshops – in which potential sources of flammable vapour ignition may exist. Boundaries of such spaces shall be insulated to A-60 Class standard, with the exception of the boundaries facing the cargo area.

In the above-mentioned boundaries, openings closed with bolted plates, for the removal of machinery may be provided.

In these boundaries, the navigation bridge doors and windows may be fitted, provided they are gastight<sup>1)</sup>.

In these boundaries, access to a deck foam system room (including the foam tank and control station) is permitted, provided that the door is located flush with the bulkhead.

**6.3.2.5.5** Windows and sidescuttles facing the cargo area and installed on the sides of the superstructures and deckhouses within the limits specified in 6.3.2.5.3 shall be of the fixed (non-opening) type. Such windows and sidescuttles, except wheelhouse windows, shall be constructed to A-60 Class standard.

The location of the windows and sidescuttles shall correspond to a prototype subjected to fire test with the fire against its external side (i.e. the side which, after installation on board, will be exposed to the weather).

Windows and sidescuttles mounted in excess of the limits, specified in 6.3.2.5.3, may be constructed to A-0 Class standard.

**6.3.2.5.6** Rubbing strakes shall be made of, or faced with, material precluding spark formation.

### **6.3.3 Fire Integrity of Bulkheads and Decks**

**6.3.3.1** The minimum fire integrity of vertical divisions (partitions, bulkheads) separating adjacent spaces shall be in accordance with Table 6.3.3-1 and the minimum fire integrity of decks – in accordance with Table 6.3.3-2.

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<sup>1)</sup> The navigation bridge external doors and windows considered gastight shall be tested for gastightness. If a water hose test is applied, the following shall be taken as a guide:

- nozzle diameter: minimum 12 mm;
- water pressure just before the nozzle: not less than 0.2 MPa; and
- distance between the nozzle and the doors or windows: maximum 1.5 m.





**Notes to Table 6.3.3-1 and Table 6.3.3-2, as appropriate:**

- a) For clarification as to which applies, see 2.2.3 and 2.2.4.
- b) Where spaces are in the same numerical category, a bulkhead or deck of the rating shown in the Tables is only required when the adjacent spaces are for a different purpose, for example, 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 navigation bridge, the chartroom and radio room from each other may be of 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 gastight seals with efficient lubrication or other means ensuring the permanence of the gas seal are fitted in way of the bulkhead or deck penetrations.
- e) Fire insulation need not be fitted in the machinery space in category (7) of low fire risk. To determine such machinery space – see 6.1.4.2(10).
- \* 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 shall be made tight to prevent the passage of flame and smoke. Divisions between control stations (emergency generators) and open decks may have air intake openings without means for closure, unless a fixed gas fire-fighting system is fitted.

**6.3.3.2** The principles, given in 2.2.2.2, shall govern the application of the Tables.

The spaces have been subdivided into 10 categories according to their fire risk:

**(1) Control stations:**

- spaces containing emergency sources of power and lighting (battery rooms and spaces containing emergency power generating units);
- wheelhouse and chartroom, radar transmitter rooms;
- spaces containing the ship's radio equipment;
- fire control station;
- control rooms for propulsion machinery when located outside the machinery space;
- spaces containing centralised fire alarm equipment.

**(2) Corridors** – corridors and lobbies.**(3) Accommodation spaces** – see the definitions given 1.2.51, 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. A stairway which is enclosed at one level only shall be regarded as part of the space from which it is not separated by a fire door.**(5) Service spaces (low fire risk):**

- lockers and store-rooms not having provisions for the storage of flammable liquids and having areas less than 4 m<sup>2</sup> as well as drying rooms and laundries;

- identifiable spaces containing electrical distribution boards (having a deck area of 4 m<sup>2</sup> or less);
  - refrigerated provision chambers thermally insulated with non-combustible material.
- (6) **Machinery spaces of category A** – spaces as defined in sub-chapter 1.2.65.
- (7) **Other machinery spaces:**
- spaces as defined in 1.2.64, excluding machinery spaces of category A;
  - rooms containing electrical equipment, e.g. auto-telephone exchange, distribution boards, air-conditioning duct spaces.
- (8) **Cargo pump-rooms** – all spaces containing cargo pumps including trunkways and hatchways to such spaces.
- (9) **Service spaces (high fire risk)** – galleys, pantries containing cooking appliances, paint and flammable liquids rooms, lockers and store-rooms having areas of 4 m<sup>2</sup> or more, saunas, as well as workshops other than those forming part of the machinery spaces, garbage handling and storage spaces, as well as refrigerated provision chambers thermally insulated with combustible material.
- (10) **Open decks** – open deck spaces and enclosed promenades having no fire risk, as well as air spaces outside superstructures and deckhouses.

**6.3.3.3** Permanent gastight glazed ports, of approved type, for illuminating cargo pump-rooms, may be fitted in bulkheads and deck separating cargo pump-rooms and other spaces, provided they are of adequate strength and the fire integrity and gastightness of the bulkhead or deck is maintained.

Glazed ports shall be protected against mechanical damage and shall be provided with strong covers capable of being closed from outside the cargo pump-room.

Glazed ports shall be so constructed that glass and sealing will not be impaired by the working of the ship.

The glass and the protection of the light fitting shall not impair the integrity of the bulkhead and shall be of equivalent strength.

The fitting shall have the same resistance to fire and smoke as the unpierced bulkhead.

**6.3.3.4** Skylights to cargo pump-rooms shall be made of steel, shall not contain any glass and shall be capable of being closed from outside the pump-room.

**6.3.3.5** The construction and arrangement of saunas shall comply with the requirements stated in 6.1.1.7. The sauna shall be insulated to A-60 Class standard against other spaces except those inside of the perimeter and spaces of categories (5), (7) and (10), specified in 6.3.3.2.



### **6.3.4 Cargo Tank and Pump-Room Fire Protection**

#### **6.3.4.1 Fixed Deck Foam Systems**

**6.3.4.1.1** Tankers, irrespective of their deadweight, shall be provided with a fixed deck foam system in accordance with the requirements specified in 3.9 to protect the cargo tanks deck.

**6.3.4.1.2** For tankers of 20 000 tonnes deadweight and upwards, an equivalent fixed installation is permitted provided that such an installation shall:

- .1** be capable of extinguishing spill fires (of spilled cargo) and also preclude ignition of spilled oil not yet being ignited;
- .2** be capable of combating fires in ruptured tanks.

**6.3.4.1.3** Tankers with fore or aft loading stations (located outside the cargo area) shall be provided with foam system for protecting these stations, of the capacity 6 l/min per 1 m<sup>2</sup> of the surface area.

#### **6.3.4.2 Inert Gas Systems**

**6.3.4.2.1** Tankers of 20 000 tonnes deadweight and upwards shall be fitted with an inert gas system.

The inert gas system shall be capable of inerting, purging and gas-freeing empty tanks and maintaining the atmosphere in cargo tanks with the required oxygen content.

The inert gas system shall be designed, constructed and tested in accordance with the requirements specified in 3.10.

**6.3.4.2.2** All tankers, irrespective of their deadweight, operating with cargo tank cleaning procedure using crude oil washing shall also be fitted with an inert gas system in accordance with the requirements specified in 3.10.

**6.3.4.2.3** Where an installation equivalent to a fixed inert gas system is installed, it shall be:

- .1** 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** so designed as to minimise the risk of ignition from the generation of static electricity by the system itself.

**6.3.4.2.4** Tankers required to be fitted with inert gas systems shall fulfil the following requirements:

- .1** double hull spaces and segregated ballast tanks adjacent to cargo tanks shall be fitted with suitable connections for the supply of inert gas;
- .2** where such hull spaces or tanks are connected to a permanently fitted inert gas distribution system, means shall be provided to prevent hydrocarbon

gases from the cargo tanks entering such double hull spaces or tanks through the system; and

- .3 where such spaces or tanks are not permanently connected to an inert gas distribution system, proper hose assemblies shall be used to allow connection to the inert gas main.

Ballast system pipes are permitted to be used for conveying inert gas to the separated ballast tanks.

#### **6.3.4.3 Arrangements for Gas Measurement in Double Hull and Double Bottom Spaces**

**6.3.4.3.1** Construction of the double hull spaces shall be such as to enable measuring oxygen and flammable vapour concentrations in such spaces with portable flammable vapour detectors using flexible gas sampling hoses.

**6.3.4.3.2** Where the atmosphere in double hull spaces cannot be reliably measured using flexible gas sampling hoses, such spaces shall be fitted with permanent gas sampling lines. The configuration of gas sampling lines shall be adapted to the design of such spaces.

**6.3.4.3.3** The materials of construction and diameters of gas sampling lines shall be such as to prevent their restriction. Where such lines are made of plastic materials, they should be electrically conductive.

**6.3.4.3.4** In addition to compliance with the requirements concerning portable equipment for measuring oxygen and for measuring flammable vapour concentrations, specified in 6.3.11, oil tankers of 20,000 tonnes deadweight and above shall be provided with fixed hydrocarbon gas detection system in accordance with the requirements specified in 4.4.

**6.3.4.3.5** Oil tankers provided with constant operative inerting systems for such spaces need not be equipped with fixed hydrocarbon gas detection equipment.

**6.3.4.3.6** Cargo pump-rooms provided with additional arrangements to prevent explosion in cargo pump-rooms, as required in 6.3.5.2, need not be equipped with fixed hydrocarbon gas detection system.

#### **6.3.4.4 Detection of Flammable Vapours on Combination Carriers**

An approved fixed gas warning system capable of monitoring flammable vapours shall be provided in cargo pump-rooms, pipe ducts and cofferdams, mentioned in 6.3.2.4, adjacent to slop tanks. Suitable arrangements shall be made to facilitate measurement of flammable vapours in all other spaces within the cargo area. Such measurements shall be made possible from the open deck or easily accessible positions.

### **6.3.4.5 Portable Fire-Extinguishers**

On tankers with open deck, at least two portable fire-extinguishers shall be provided.

### **6.3.4.6 Pipe Trunk within Cargo Tanks Deck Area**

Where an enclosed pipe trunk is situated within the cargo tanks deck area, the pipe trunk:

- .1** shall be protected by one of the fixed fire-extinguishing systems (total flooding) required in 6.3.5.1. The extinguishing system shall be operated from a readily accessible position outside the pipe trunk;
- .2** is not considered part of the cargo tanks deck area;
- .3** the area of the pipe trunk need not be included in the calculation of the foam solution rate of supply for the fixed deck foam system required in 6.3.4.1;
- .4** shall be adequately ventilated and provided with lighting interlocked with ventilation, as well as system for continuous monitoring of the concentration of hydrocarbon gases, in accordance with the requirements for cargo pump-rooms, specified in 6.3.5.2;
- .5** shall contain no flammable gas sources other than pipes and flanges. If the pipe trunk contains any other source of flammable gas, i.e. valves and pumps, it shall be regarded as a cargo pump-room.

### **6.3.5 Fire Protection of Cargo Pump-rooms**

The requirements specified in the present sub-chapter apply to pump-rooms containing pumps for cargo, such as cargo pumps, stripping pumps, pumps for slop tanks, pumps for COW or similar pumps.

Pump-rooms intended solely for ballast transfer or oil fuel transfer need not fulfil these requirements.

#### **6.3.5.1 Total Flooding Fixed Fire-Extinguishing Systems**

**6.3.5.1.1** Each cargo pump-room shall be provided with one of the following fixed total flooding fire-extinguishing systems suitable for the protection of machinery spaces of category A:

- .1** carbon dioxide system operated from a readily accessible position outside the pump-room in accordance with the requirements specified in 3.6 or equivalent gas fire-extinguishing system, referred to in 3.7, complying with the following requirements:
  - warning signalization shall comply with the requirements specified in 4.3 and 6.3.5.3;
  - a notice shall be exhibited at the controls stating that due to the electrostatic ignition hazard, the system is to be used solely for fire extinguishing and not for inerting purposes;

- .2 high-expansion foam system in accordance with the requirements specified in 3.5.3, provided that the foam concentrate supply is suitable for extinguishing fires involving the cargoes carried;
- .3 water-spraying fire-extinguishing system in accordance with the requirements specified in 3.4.4.

The system shall be operated from an easily accessible position outside the cargo pump-room.

**6.3.5.1.2** 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.

### **6.3.5.2 Additional Arrangements to Prevent Explosion in Cargo Pump-rooms**

Cargo pump-rooms shall be fitted with:

- .1 temperature monitoring system for pumps, driven by shaft passing through pump-room bulkheads, such as: cargo pumps, slop pumps, ballast pumps, stripping pumps, tank cleaning pumps (except small pumps of 1 m<sup>3</sup>/h capacity or less and bilge pumps). Sensing points shall be provided on bulkhead shaft glands, bearings and pump casing. The setting point shall be about 60 – 80 °C. The sensing points shall be permanently fixed. When the set point is reached, a signal shall be automatically effected in cargo central room or the pump control station;
- .2 lighting interlocked with ventilation;
- .3 a system for continuous monitoring of the concentration of hydrocarbon gases in accordance with the guidelines given in MSC.1/Circ.1321, Part IV, Chapter. 3.2;
- .4 bilge<sup>1)</sup> level monitoring devices,

in accordance with the requirements specified in sub-chapter 22.5.7, *Part VIII – Electrical Installations and Control Systems*.

### **6.3.5.3 Pre-discharge Alarms in Cargo Pump-Room**

Where a gas fire-extinguishing system is applied, an alarm system warning of the release of an extinguishing medium to the cargo pump-room required in 3.6.3.7 shall:

- .1 be air-operated and the air supply shall be properly dried and clean. Application of CO<sub>2</sub> operated alarms is not permitted owing to the possibility of the generation of static electricity in the CO<sub>2</sub> cloud; or
- .2 electrically operated, and the arrangements shall be of an explosion-proof type and such that the electric actuating mechanism is located outside the pump room except where the alarms are certified intrinsically safe.

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<sup>1)</sup> Bilge high-level alarms are acceptable as an alternative means for the level monitoring devices.

#### **6.3.5.4 Portable Fire-Extinguishers**

In each cargo pump-room, at least two portable fire-extinguishers shall be provided.

#### **6.3.5.5 Control of Ignition Sources**

**6.3.5.5.1** Any potential ignition sources shall be effectively protected.

**6.3.5.5.2** Any penetration (including a movable part) of the engine room boundary or safety area passing through a pump-room bulkhead shall be provided with the following:

- .1 gas-tight sealing device with efficient lubricant (periodic greasing type is not permitted); and
- .2 temperature measuring device.

#### **6.3.5.6 Fire Detection and Alarm System**

Cargo pump-rooms shall be fitted with fixed fire detection and alarm system, of approved type, complying with the applicable requirements specified in 6.16.2. The system shall be suitable for use in explosive atmosphere.

#### **6.3.6 Fire-Extinguishing Arrangements in Machinery Spaces**

Machinery spaces of category A in all tankers irrespective of gross tonnage shall be provided with fixed total flooding fire-extinguishing system in accordance with the requirements specified in 2.5.1.1.

#### **6.3.7 Requirements for Paints and Flammable Liquids Store-Rooms**

**6.3.7.1** Paints and flammable liquids store-rooms shall fulfil the requirements specified in sub-chapter 2.8.

These requirements are not applicable to store-rooms regarded as cargo service spaces intended for the stowage of cargo samples, when such spaces are situated within the cargo area.

**6.3.7.2** Paint lockers, irrespective of their use, shall not be located above the cargo tanks, slop tanks and compartments separating the cargo tanks or slop tanks from the machinery spaces.

#### **6.3.8 Water Fire Main System**

**6.3.8.1** In addition to the requirements specified in the present sub-chapter, water fire main system shall fulfil the requirements specified in sub-chapter 3.2.

**6.3.8.2** Where an emergency fire pump is located in the forebody, means shall be provided to ensure operation of this pump, as well as sea valves from both the pump-room and open deck.

**6.3.8.3** Isolating valves shall be fitted in the water 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.

An information plate shall be provided at each valve to indicate that the valve shall be always kept open during the ship's normal operation.

**6.3.8.4** Before each isolating valve on the water fire main located on cargo deck, twin fire hydrants of 50 mm in diameter – for ships of gross tonnage not exceeding 1000, and of 65 mm in diameter – for ships of gross tonnage more than 1000 shall be fitted, spaced equally over the length of the cargo deck.

**6.3.8.5** Ships with fore loading stations and single point mooring arrangements shall be provided with the sprinkler system for drenching the anchor stoppers, with the application rate 5 l/min per 1 m<sup>2</sup> of the horizontal projection of the anchor stoppers, permanently connected to the water fire main system.

**6.3.8.6** Fire hose attachment fittings shall not cause risk of sparking. Fire hose coupling and nozzles used in the open deck area shall not be made from aluminium alloys.

### **6.3.9 Application of Aluminium Coatings**

The application of aluminium coatings is prohibited in cargo tanks, cargo deck area, cargo pump-rooms, cofferdams and any other area where flammable vapour of cargo may accumulate.

Aluminised pipes may be permitted in:

- .1** ballast tanks;
- .2** inerted cargo tanks;
- .3** hazardous areas on open deck, provided the pipes are protected from accidental impact.

### **6.3.10 Fire-Fighter's Outfits**

On each tanker, at least two fire-fighter's outfits shall be provided in accordance with the requirements specified in 5.1.4, additional to those required in 5.1.4.1.

### **6.3.11 Portable Instruments for Measuring Flammable Vapour and Oxygen Concentrations**

**6.3.11.1** Each tanker shall be equipped with at least two portable gas detectors capable of measuring flammable vapour concentrations and at least two portable instruments for measuring oxygen concentrations, together with a sufficient set of spares. Suitable means shall be provided for calibration of such instruments. Alternatively, at least two dual-purpose type instruments capable of measuring both oxygen and flammable vapours concentrations can be provided on board.

These instruments shall be capable of measuring flammable vapour concentrations in double hull and double bottom spaces in connection with fixed air sampling pipings, referred to in 6.3.4.3.2.

**6.3.11.2** In addition, for tankers fitted with inert gas systems, at least two portable gas detectors shall be provided capable of measuring concentrations of flammable vapours in inerted atmosphere.

**6.3.11.3** Suitable arrangement shall be made on each cargo tank such that the condition of the tank atmosphere can be determined using these portable instruments.

## **6.4 Product Carriers Carrying Cargoes having a Flash-Point Exceeding 60 °C – Mark: PRODUCT CARRIER B**

### **6.4.1 Ship Construction**

The product carriers shall, in general, fulfil the requirements for cargo ships, specified in Chapter 2. In respect of the fire integrity of vertical and horizontal divisions separating adjacent spaces, the relevant requirements for cargo ships, other than tankers, specified in 2.2.2, apply. Cargo pump-rooms shall be treated as machinery spaces of category A.

### **6.4.2 Arrangement and Separation of Spaces**

The arrangement of spaces with respect to cargo tanks shall fulfil the requirements specified in 6.3.2, as appropriate, except the requirements regarding the hazardous cargo pump-rooms and cargo area.

Superstructure exterior boundaries and windows facing the cargo area need not be of A-60 Class standard.

### **6.4.3 Fire Protection of Cargo Tanks, Machinery Spaces and Cargo Pump-Rooms**

**6.4.3.1** The tankers shall fulfil the requirements specified in Chapter 2, except that instead of the fixed gas fire-extinguishing system required in 2.6.1 for the protection of cargo spaces, it shall be fitted with a fixed deck foam fire-extinguishing system for the protection of the cargo tank area in accordance with the requirements specified in sub-chapter 3.9.

The tankers of less than 2000 gross tonnage need not be fitted with the fixed deck foam fire-extinguishing system.

**6.4.3.2** Fire protection of the machinery spaces shall fulfil the requirements specified in sub-chapter 2.5.

**6.4.3.3** Cargo pump-rooms shall be treated as machinery spaces of category A and the fire protection arrangements shall be in accordance with sub-chapter 2.5.

**6.4.3.4** Where cargo tanks are provided with cargo heating arrangements, the possibility of the temperature measurement in cargo tanks shall be ensured and means shall be provided to prevent the cargo from being heated to a temperature that would constitute fire risk.

#### **6.4.4 Water Fire Main System**

Water fire main system shall additionally fulfil the requirements specified in 6.3.8.

#### **6.4.5 Fire-Fighter's Outfits**

On each tanker, two additional fire-fighter's outfits shall be provided in accordance with the requirements specified in 5.1.4.

### **6.5 Special Purpose Ships – Mark: SPECIAL PURPOSE SHIP**

#### **6.5.1 General**

**6.5.1.1** For ships carrying not more than 60 persons of special personnel on board, the fire protection requirements for cargo ships, specified in Chapter 2, shall be applied.

**6.5.1.2** For ships carrying more than 60, but not more than 240 persons of special personnel on board, the fire protection requirements for passenger ships carrying not more than 36 passengers, specified in sub-chapter 6.1, shall be applied.

**6.5.1.3** For ships carrying more than 240 persons of special personnel on board, the fire protection requirements for passenger ships carrying more than 36 passengers, specified in sub-chapter 6.1, shall be applied.

**6.5.1.4** The minimum fire integrity of bulkheads and decks separating industrial spaces in ships, mentioned in paragraphs 6.5.1.1 and 6.5.1.2, shall fulfil the requirements specified in 2.2.2.2 for service spaces of category (5) or (9), respectively, whereas in ships mentioned in paragraph 6.5.1.3 – the requirements specified in paragraph 6.1.4.2 for spaces of category (10) or (14), respectively.

**6.5.1.5** In industrial spaces, where due to their functions, A-60 Class fire division cannot be made, water screen system complying with the requirements specified in 3.4.9 may be applied.

#### **6.5.2 Store-Rooms for Explosives**

**6.5.2.1** In special purpose ships, the arrangement of store-rooms for explosives may be made, provided the requirements specified in paragraphs 6.5.2.2 to 6.5.2.22 are fulfilled. The store-rooms of the following type may be provided:

- .1** built-in store-rooms – spaces which constitute part of the ship's hull structure;
- .2** portable self-contained store-rooms – spaces which do not constitute part of the ship's hull structure, of the volume of 3 m<sup>3</sup> or more;
- .3** portable boxes for the storage of explosives – boxes which do not constitute part of the ship's hull structure, of the volume less than 3 m<sup>3</sup>.



**6.5.2.2** Built-in store-rooms shall be situated in the forward or after part of the ship's hull and shall be separated from the propeller shaft, propeller and rudder by at least one watertight compartment. Store-rooms shall not be located under accommodation spaces, control stations and fuel storage spaces, neither be adjacent thereto.

**6.5.2.3** Built-in store-rooms shall not be adjacent to machinery spaces of category A, boiler rooms, galley and other fire hazardous spaces. If, however, such location cannot be avoided, a cofferdam of at least 0.6 m in width, separating these spaces, shall be provided. The cofferdam shall be fitted with ventilation and shall be empty. One of the walls enclosing the cofferdam shall be of A-15 Class division. Where the cofferdam is adjacent to machinery space of category A, the isolating wall shall be of A-30 Class division.

**6.5.2.4** Access to store-rooms built in the ship's hull shall be provided from the open deck through a watertight or gastight door. In no case shall the access to store-rooms be provided through spaces mentioned in paragraphs 6.5.2.2 and 6.5.2.3.

**6.5.2.5** Self-contained store-rooms and boxes for explosives shall be located on the open deck in protected places.

**6.5.2.6** Boxes for the storage of explosives shall be located on the open deck in places affording easy disposal of the content of the boxes overboard in case of emergency.

**6.5.2.7** Bulkheads and decks forming store-rooms for explosives shall be watertight and constructed of steel. They shall be of A-15 Class division. Insulation preventing water condensation shall be provided.

**6.5.2.8** Pipelines of fresh water, sea water and bilge installation may be run through store-rooms for explosives.

Pipelines of other installations may be run through the store-rooms, provided they are encased in a watertight duct.

**6.5.2.9** Doors and covers of store-rooms shall be provided with means enabling them to be locked.

**6.5.2.10** Store-rooms shall be fitted with shelves. The construction and the capacity of the shelves shall be such as to secure the safe stowage of the entire store of explosives in containers of the approved type and to preclude the latter from shifting or falling in case of roll.

The upper shelf shall not be located higher than 1.8 m above the floor. The shelves shall have holes to facilitate the flow of water from the upper to the lower shelves during the operation of the water-spraying system.

**6.5.2.11** The floor of store-rooms shall be covered with permanent, antislip material precluding spark formation, such as floor-mats.

**6.5.2.12** The free volume of the store-room, when loaded, shall be at least 70% of the entire store-room space and the cubic capacity of the store-room shall be not less than one cubic metre per each 100 kg of explosives or 1000 detonating fuses.

**6.5.2.13** Store-rooms built in the ship's hull shall be provided with natural or mechanical ventilation which would ensure the temperature inside store-rooms not exceeding 38 °C. Openings of this ventilation shall be provided with flame arresters.

**6.5.2.14** Portable store-rooms shall be provided with an effective natural ventilation, the inlet and outlet openings of the ventilation being fitted with flame arresters.

**6.5.2.15** Store-rooms shall be fitted with automatic temperature alarms whose detectors will operate at temperatures rising above 40 °C. An appropriate signal indicator shall be provided on the navigation bridge and in the ship's fire officer cabin.

**6.5.2.16** Built-in and portable store-rooms for explosives shall be fitted with water-spraying system in accordance with the requirements specified in 3.4. Control devices shall be clearly marked.

**6.5.2.17** Scuppers shall be fitted in the store-room decks. The scupper pipes shall be fitted with valves which shall be kept permanently closed under normal service conditions. The valves shall be controlled from outside the store-room.

**6.5.2.18** Portable store-rooms shall be fitted with plates stating the weight of the empty store-room and the weight of the store-room loaded to a maximum.

**6.5.2.19** Boxes for the stowage of explosives shall be watertight and constructed of metal. The thickness of the walls and cover of the boxes shall be not less than 3 mm. Surfaces exposed to a direct solar radiation shall be provided with a protective screen.

**6.5.2.20** Store-rooms shall be provided with the following conspicuous inscriptions:

- .1 Store-room for explosives;
- .2 Do not approach with open fire;
- .3 Keep the door closed.

**6.5.2.21** Boxes for the stowage of explosives shall be provided with the following conspicuous inscriptions:

- .1 Box for the stowage of explosives;
- .2 Do not approach with open fire;
- .3 Unauthorised opening prohibited.

**6.5.2.22** Special rooms shall be provided for the stowage of fuses.

**6.5.2.23** Electrical equipment of the store-rooms for explosives shall fulfil the requirements specified in sub-chapter 22.5.3, Part VIII – Electrical Installations and Control Systems.

### **6.5.3 Fire Detection and Fire Alarm System**

**6.5.3.1** Fire detection and fire alarm system shall be provided in ships of 1000 gross tonnage and upwards and in the case when method IIC of fire protection is applied – also in ships of 500 gross tonnage and upwards.

In spaces fitted with automatic sprinkler system, fire detection and fire alarm system need not be provided.

**6.5.3.2** Fire detection and fire alarm system shall be provided in the following spaces:

- .1 accommodation and service spaces;
- .2 store-rooms for explosives, readily ignitable materials and flammable liquids, as well as welding shops;
- .3 control stations (except CCS, accumulator battery rooms and converter rooms);
- .4 cargo spaces intended for the carriage of dangerous goods.

**6.5.3.3** Manually operated call points shall be provided in the following places:

- .1 corridors of accommodation, service and public spaces;
- .2 entrance halls;
- .3 public spaces having an area of more than 150 m<sup>2</sup>;
- .4 machinery spaces of category A and main control stations;
- .5 industrial spaces.

### **6.5.4 Early Detection of Fire in Periodically Unattended Machinery Spaces**

On special purpose ships carrying not more than 240 persons on board, in periodically unattended machinery spaces, means shall be provided for early detection of fire in accordance with the requirements specified in 6.16.5.

## **6.6 Tugs and Supply Vessels – Marks: TUG, SUPPLY VESSEL**

**6.6.1** In each tug and supply vessel of gross tonnage 150 and upwards or with combined propulsion power more than 735 kW, machinery spaces of category A shall be fitted with total-flooding fire-extinguishing systems in accordance with the requirements specified in 2.5.1.1.

**6.6.2** Tugs and supply vessels serving crude oil tankers, product carriers and barges carrying cargoes with a flash-point not exceeding 60°C shall, additionally, fulfil the following requirements:

- .1 the ship shall be provided with a fixed deck foam fire-extinguishing system complying with the applicable requirements specified in 3.9, capable of delivering foam to the open deck. Instead of the fixed deck foam fire-extinguishing system, 45 l capacity mobile foam-type fire-extinguishing unit with a reeled hose ensuring delivery of the foam to the open deck, is permitted;
- .2 exhaust pipes shall be fitted with spark arresters in accordance with the requirements specified in paragraph 10.1.3, *Part VI – Machinery Installations and Refrigerating Plants*;
- .3 internal combustion engine silencers shall be fitted with local gas fire-extinguishing system independent of the machinery space fire-extinguishing system;
- .4 rubbing strakes and deck equipment shall be so made as to preclude spark formation.

## **6.7 Floating Cranes – Mark: FLOATING CRANE**

**6.7.1** The number of the main fire pumps and the pressure of the discharged water shall be in accordance with Table 3.2.1.1, except that in floating cranes with gross tonnage less than 2000, only one fire pump is required.

**6.7.2** Water fire main system shall have one branch on either side led out to the open deck, terminated with an international shore connection complying with the requirements specified in 3.2.9 and intended to provide a supply of water from an extraneous source to all fire-extinguishing systems.

## **6.8 Container Ships – Mark: CONTAINER SHIP**

### **6.8.1 Water Fire Main System**

On open decks intended for the carriage of freight containers, the arrangement of fire hydrants shall be such that at least two jets of water not emanating from the same hydrant through a single length of hose will reach each container side wall.

### **6.8.2 Water-Spraying System**

Open-top container holds shall be protected by a fixed water-spraying system in accordance with the requirements specified in 3.4.8.

### **6.8.3 Fire Detection and Alarm System**

Whenever a fire detection and fire alarm system is required in the open hold area, the system shall be designed and arranged to take account of the specific hold, container configuration and ventilation.

## **6.9 Oil Recovery Vessels – Mark: OIL RECOVERY VESSEL**

### **6.9.1 Ship Construction**

**6.9.1.1** The hull, superstructures, deckhouses and decks shall be constructed of steel. The use of aluminium alloys for these structures is not permitted.

**6.9.1.2** The ship structure, fire integrity of vertical bulkheads and decks shall fulfil the applicable requirements for tankers carrying cargoes with a flash-point not exceeding 60°C, set forth in 6.3.2 and 6.3.3.

**6.9.1.3** Exterior boundaries of superstructures and deckhouses shall be of A-60 Class over the whole height from the upper deck upwards, unless the application rate of water screens in accordance with the requirements of 6.9.2.2 allows reduction of the insulation thickness.

**6.9.1.4** Superstructure windows and sidescuttles shall be of A-0 standard and shall be fitted with steel covers.

**6.9.1.5** Exits from superstructures and deckhouses to the open deck and leading to the spaces which constitute an explosion hazard shall be provided with two gastight doors, spaced at least 1.5 m apart. The outer doors shall be of self-closing type. The door sills shall be at least 300 mm high.

Air locks need not be arranged in compartments that are not adjacent to accommodation spaces having exits to the open deck, provided that:

- .1** the compartments are permanently closed and are not used during the ship's operation in the oil spillage area;
- .2** electrical equipment installed therein is of an explosion-proof type.

Also, air locks need not be provided at the exits from the navigation bridge to the open deck.

**6.9.1.6** Each opening in cargo tanks intended for the recovered oil shall be provided with gastight closing appliances.

**6.9.1.7** Decks and walls forming the boundaries of the enclosed spaces intended for the storage of the loose gear used for collecting the spilled oil shall fulfil the requirements specified in Table 6.3.3-1 and Table 6.3.3-2 relating to spaces of category (9).

**6.9.1.8** Spaces intended for the storage of the loose gear used for collecting the spilled oil may serve as cofferdams.

Subject to PRS' consent, in ships of restricted service, cofferdams separating the machinery spaces of category A from cargo tanks need not be installed, provided that a bulkhead constructed of uniform plate ensuring access for inspections and hydraulic tests of the tanks during the ship's surveys is fitted.

## **6.9.2 Water Screen System**

**6.9.2.1** Ships shall be provided with the water screen system for drenching the exterior boundaries of the superstructure in accordance with the applicable requirements specified in sub-chapter 3.4.

**6.9.2.2** Application rate of the water screen system shall be at least 15 l/min per linear length of the boundary.

Where the insulation of the exterior boundaries is not of A-60 Class, the application rate shall be at least 30 l/min per linear length of the boundary.

**6.9.2.3** Water screen system for drenching the exterior boundaries of the superstructure shall be operated remotely from the navigating bridge.

## **6.9.3 Foam Fire-Extinguishing System**

Ships shall be provided with a foam fire-extinguishing system in accordance with the requirements specified in 3.5.4. The system shall be capable of delivering foam to the open deck and intended for the protection of the recovered oil tanks, as well as of the enclosed spaces intended for the storage of the loose gear for collecting the spilled oil.

## **6.9.4 Water Fire Main System**

Water fire main system shall fulfil the following additional requirements:

- .1** it shall be made as in tankers and fulfil the relevant requirements specified in 6.3.8;
- .2** fire water pumps shall be supplied with water from bottom sea valves only. The side sea valve shall be capable of being closed;
- .3** fire pumps shall be remotely controlled from the navigation bridge.

## **6.9.5 Fire-Extinguishing Systems for Protection of Machinery Spaces**

**6.9.5.1** Fire-extinguishing systems intended for the protection of machinery spaces shall be remotely controlled from the navigation bridge. Exits to the open deck from the fire-extinguishing stations protecting these spaces need not be provided.

**6.9.5.2** High-expansion foam fire-extinguishing system shall not be used for the protection of machinery spaces.

## **6.9.6 System for Determining Concentration of Flammable Gases**

**6.9.6.1** Fixed system for an automatic determining the concentration of flammable hydrocarbon gases and vapours shall be provided. The system shall:

- .1** operate continuously when the ship is in the area of oil spillage and during collecting the oil;

- .2 be composed of safe elements suitable for application in explosive atmosphere in accordance with the relevant requirements specified in sub-chapter 22.5.4.2, *Part VIII – Electrical Installations and Control Systems*;
- .3 be provided with the sampling arrangements or detectors made of materials resistant to the marine atmosphere and hydrocarbon gases and vapours. The cross-section and length of the sampling arrangement piping shall be such as to ensure the supply of the samples of air to the analyser within not more than 1 minute;
- .4 be fitted with automatic change-over arrangements ensuring the successive control of the air content in all places in which the sampling system or detectors have been installed. Intervals between one changing over and the next one shall be such as to enable the sample to reach the analyser;
- .5 give audible and visual signals in the following cases:
  - exceeding by 30% the normal level of hydrocarbons concentration in the air, such signals being simultaneously announced on the navigation bridge;
  - interference in the supply of electric power to analyser;
  - clogging the piping between the sampling arrangement and the analyser.

**6.9.6.2** Sampling arrangements or detectors of the system for determining the concentration of hydrocarbon gases or vapours shall be located as follows:

- .1 in the vicinity of openings in the intake ventilation;
- .2 in at least two positions on the open deck at a level not exceeding 1.0 m above the deck;
- .3 in machinery spaces – in air locks;
- .4 in cofferdams of cargo tanks.

## **6.10 Ro-Ro Passenger Ships – Mark: RO-RO/PASSENGER SHIP**

The requirements specified in 6.10 apply to passenger ships provided with ro-ro cargo spaces or special category spaces and are supplementary to those specified in sub-chapters 6.1 and 6.2.

### **6.10.1 Escape Routes**

#### **6.10.1.1 General**

**6.10.1.1.1** Escape routes shall be provided from every normally occupied space/group of spaces on the ship to an assembly station. These escape routes shall be so arranged as to provide the most direct route possible to the assembly station, and shall be appropriately marked, see 6.1.6.10.5.

**6.10.1.1.2** Escape route from cabins to stairway enclosures shall be as direct as possible, with a minimum number of changes in direction. It shall not be necessary to cross from one side of the ship to the other to reach an escape route. It shall not be necessary to climb more than two decks up or down in order to reach an assembly station or open deck from any passenger space.

**6.10.1.1.3** External routes shall be provided from open decks to the lifeboats or liferafts embarkation stations.

**6.10.1.1.4** Where enclosed spaces adjoin an open deck, openings from the enclosed space to the open deck shall, where practicable, be capable of being used as an emergency exit.

**6.10.1.1.5** Escape routes shall not be obstructed by furniture and other obstacles. With the exception of tables and chairs, cabinets and other heavy furnishings in public spaces and along escape route shall be secured in place to prevent shifting if the ship rolls or lists. Floor coverings shall also be secured in place.

### **6.10.1.2 Instructions for Safe Escape**

**6.10.1.2.1** Decks shall be sequentially numbered, starting with “1” at the tank top or the lowest deck. The numbers shall be prominently displayed at stairs landings and lift lobbies. Decks may also be named, but the deck number shall always be displayed with the name.

**6.10.1.2.2** Simple plans showing the “YOU ARE HERE” position and escape routes marked by arrows shall be prominently displayed on the inside of each cabin door and in public spaces. The plan shall show the directions of escape, and shall be properly oriented in relation to its position on the ship.

### **6.10.1.3 Strength of Handrails and Corridors**

**6.10.1.3.1** Handrails or other handholds shall be provided in all corridors along the entire escape route to the assembly and embarkation stations. Such handrails shall be provided on both sides of longitudinal corridors of more than 1.8 m in width and transverse corridors of more than 1 m in width. Particular attention shall be paid to the need to be able to cross lobbies, atriums and other large open spaces along escape routes. Handrails and other handholds shall be of such strength as to withstand a uniformly distributed horizontal load of 750 N/m applied in the direction of the centre of the corridor or space, and a uniformly distributed vertical load of 750 N/m applied in downward direction. The two loads need not be applied simultaneously.

**6.10.1.3.2** The lowest 0.5 m of bulkheads or other partitions forming vertical divisions along escape routes shall be able to sustain a load of 750 N/m to allow them to be used as walking surfaces from the side of the escape route with the ship at large angles of heel.

### **6.10.1.4 Evacuation Analysis**

Escape routes shall be evaluated based on an evacuation analysis. The analysis shall identify and eliminate, as far as practicable, congestion which may develop



during an abandonment due to normal movement of passengers and crew along escape routes, including the possibility that crew may need to move along these routes in a direction opposite to the movement of passengers. In addition, the analysis shall demonstrate that escape arrangements are sufficiently flexible to provide for the possibility that certain escape routes, assembly stations, or embarkation stations may not be available as a result of a casualty.

It is recommended that the analysis of escape proceedings be evaluated in accordance with the guidelines contained in MSC/Circ. 1238.

### **6.10.1.5 Escape Routes from Special Category Spaces**

**6.10.1.5.1** Escape routes from special category spaces and open ro-ro spaces, to which passengers have access both below and above the bulkhead deck shall ensure safe access to the embarkation deck, at least equivalent to the requirements specified in 6.1.6.10.1.1, 6.1.6.10.2, 6.1.6.10.4.1 and 6.1.6.10.4.2.

Such spaces shall be provided with designated walkways to the means of escape between secured vehicles with a breadth of at least 0.6 m, and where practicable and reasonable those designated longitudinal walkways shall raise at least 0.15 m above the deck surface. Parking arrangements for the vehicles shall maintain the walkways clear at all times.

**6.10.1.5.2** One of the escape routes from the machinery spaces in which the crew is normally employed shall not have direct access to any special category space.

**6.10.1.5.3** Hoistable drive-up/down ramps to vehicles platform decks must not be capable of blocking the approved escape routes when in lowered position.

### **6.10.2 Fire Protection of Special Category Spaces and Ro-ro Spaces**

#### **6.10.2.1 General**

**6.10.2.1.1** As the ship division in special category spaces and ro-ro spaces into main vertical zones in accordance with the requirements specified in 6.1.2 may be impracticable, fire protection of the ship shall be ensured by the ship division into horizontal zones and fitting the spaces with a fixed fire-extinguishing system.

A horizontal zone may include special category spaces on more than one deck, provided that the total overall height (i.e. the sum of distances between deck and web frames of the decks forming one horizontal zone) for vehicles does not exceed 10 m.

**6.10.2.1.2** Decks and bulkheads forming the boundaries separating horizontal zones from each other and from the remainder of the ship shall fulfil the relevant requirements specified in the Rules concerning the ventilation systems, openings in A Class divisions and penetrations in A Class divisions for maintaining the integrity of vertical zones.

### **6.10.2.2 Structural Fire Protection**

**6.10.2.2.1** In passenger ships carrying more than 36 passengers, the boundary bulkheads and decks of special category spaces and ro-ro spaces shall be insulated to A-60 Class standard. However, where a category (5), (9) or (10) space, as defined in 6.1.4 is on one side of the division, the fire integrity standard may be reduced to A-0.

Where oil fuel tanks are below a special category space or ro-ro space, fire integrity of the deck between such spaces may be reduced to A-0 standard.

**6.10.2.2.2** In passenger ships carrying not more than 36 passengers, the vertical and horizontal boundaries of special category spaces shall be insulated as required for category (11) spaces in Tables 6.1.5-1 and 6.1.5-2, respectively.

**6.10.2.2.3** In passenger ships carrying not more than 36 passengers, the vertical and horizontal boundaries of enclosed and open ro-ro spaces shall be insulated as required for category (8) spaces in Tables 6.1.5-1 and 6.1.5-2, respectively.

**6.10.2.2.4** Indicators shall be provided on the navigation bridge and they shall indicate when any fire door leading to or from the special category spaces is closed.

**6.10.2.2.5** Doors to special category spaces shall be of such construction that they cannot be kept open permanently and shall be kept closed during the voyage.

### **6.10.2.3 Fire Detection and Alarm System**

**6.10.2.3.1** Special category spaces, as well as ro-ro spaces shall be fitted with a fixed fire detection and fire alarm system in accordance with the requirements specified in 6.2.2.1.1.

**6.10.2.3.2** If an efficient fire control patrol system is maintained in special category spaces by a continuous fire watch at all times during the voyage, a fixed fire detection and fire alarm system need not be installed.

**6.10.2.3.3** In special category spaces, manually operated call points shall be fitted and so spaced that no part of the space is more than 20 m from a manually operated call point, and one shall be placed close to each exit from such spaces.

**6.10.2.3.4** Smoke detector sections in vehicle, special category 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 shall be adapted to the time of loading/unloading. The central unit shall indicate whether the detector sections are disconnected or not.

Manually operated call points, however, shall not be capable of being disconnected by the arrangements referred to above.

#### **6.10.2.4 Fixed Fire-Extinguishing Systems**

**6.10.2.4.1** Special category spaces shall be provided with one of the following fixed fire-extinguishing systems:

- .1** water-spraying fire-extinguishing system complying with the requirements specified in 3.4.2;
- .2** equivalent high-pressure water based fire-extinguishing system, referred to in 3.4.3.

**6.10.2.4.2** Where fixed water-spraying system is 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 system, proper arrangements shall be made to drain the space in accordance with the requirements specified in sub-chapter 6.12, *Part VI – Machinery Installations and Refrigerating Plants*.

**6.10.2.4.3** Carbon dioxide systems shall not be used for the protection of special category spaces.

#### **6.10.2.5 Position of Fire Hydrants**

The requirements specified in 6.2.2.3 shall be fulfilled.

#### **6.10.2.6 Ventilation System**

The requirements specified in 6.2.2.4 shall be fulfilled.

#### **6.10.2.7 Ignition Sources**

The requirements specified in 6.2.2.5 shall be fulfilled.

#### **6.10.2.8 Scuppers and Discharges**

The requirements specified in 6.2.2.6 shall be fulfilled.

#### **6.10.2.9 Permanent Openings**

The requirements specified in 6.2.2.7 shall be fulfilled.

#### **6.10.2.10 Portable Fire-Fighting Equipment**

The requirements specified in 6.2.2.8 shall be fulfilled.

### **6.11 Gas Tankers – Mark: LIQUEFIED GAS TANKER**

Gas tankers shall fulfil the requirements of the *IGC Code*, as amended.

## **6.12 Chemical Tankers – Mark: CHEMICAL TANKER**

### **6.12.1 Application**

**6.12.1.1** Chemical tankers intended for the carriage of flammable chemicals in bulk shall fulfil the requirements of the *IBC Code*, as amended.

**6.12.1.2** Chemical tankers engaged solely in the carriage of cargoes which are non-flammable (the cargoes listed in Chapter 17 of the *IBC Code*, the entry NF in column *i* of the table of minimum requirements) shall fulfil the requirements for cargo ships specified in Chapter 2, as well as for tankers carrying cargoes with a flash-point exceeding 60°C; however, they need not be fitted with a fire-extinguishing system to protect the cargo pump-room or with a fixed deck foam fire-extinguishing system.

**6.12.1.3** Chemical tankers engaged solely in the carriage of liquid products with a flash point of 60 °C and above (entry "Yes" in column *i* of the table of minimum requirements in Chapter 17 of the *IBC Code*) shall fulfil the applicable requirements for tankers specified in sub-chapter 6.4 (they shall be fitted with a fixed deck foam fire-extinguishing system for tankers in accordance with the requirements specified in sub-chapter 3.9).

Liquid cargoes with a flashpoint exceeding 60 °C other than oil products or liquid cargoes subject to the requirements of the *International Bulk Chemical Code* are considered to constitute a low fire risk, not requiring the protection of a fixed deck foam extinguishing system.

**6.12.1.4** Chemical tankers engaged in the carriage of products with a flash point not exceeding 60 °C (entry "No" in column *i* of the table of minimum requirements in Chapter 17 of the *IBC Code*) shall, in respect of the structural fire protection and fire protection of the enclosed spaces, fulfil the requirements for tankers specified in 6.3 (except 6.3.2.3) as well as the requirements specified in this sub-chapter.

### **6.12.2 Fire Protection of Cargo Pump-Room**

**6.12.2.1** In chemical tankers engaged in the carriage of products with a flash point not exceeding 60 °C (the cargoes listed in Chapter 17 of the *IBC Code*, entry "No" in column *i* of the table of minimum requirements), irrespective of their gross tonnage, the cargo pump-room shall be provided with a fixed carbon dioxide fire-extinguishing system in accordance with the requirements specified in 6.3.5.1.1.1 or an equivalent gas fire-extinguishing system.

The amount of carbon dioxide carried shall be sufficient to provide a quantity of free gas equal to 45% of the gross volume of the cargo pump-room in all cases.

**6.12.2.2** If cargoes to be carried are not suited to extinguishment by carbon dioxide or an equivalent gas fire-extinguishing system, the cargo pump-room shall

be protected by a fire-extinguishing system consisting of either a fixed pressure water-spraying system specified in 3.4.4 or high-expansion foam system in accordance with the requirements specified in 3.5.3.

**6.12.2.3** In chemical tankers of 500 gross tonnage and upwards engaged on international voyages and engaged in the carriage of products with a flash point not exceeding 60 °C (entry "No" in column *i* of the table of minimum requirements in Chapter 17 of the *IBC Code*) cargo pump-rooms shall have:

- .1 temperature monitoring system for pumps, driven by shaft passing through pump-room bulkheads, such as: cargo pumps, slop pumps, ballast pumps, stripping pumps, tank cleaning pumps (except small pumps of 1 m<sup>3</sup>/h capacity or less and bilge pumps). Sensing points shall be provided on bulkhead shaft glands, bearings and pump casing. The setting point shall be about 60 – 80 °C. The sensing points shall be permanently fixed. When the set point is reached, a signal shall be automatically effected in cargo central room or the pump control station;
- .2 lighting interlocked with ventilation;
- .3 a system for continuous monitoring of the concentration of hydrocarbon gases in accordance with the guidelines given in MSC.1/Circ.1321, Part IV, Chapter. 3.2;
- .4 bilge level monitoring devices<sup>1)</sup>,

in accordance with the requirements specified in sub-chapter 22.5.7, *Part VIII – Electrical Installations and Control Systems*.

### **6.12.3 Fire Protection of Cargo Area**

**6.12.3.1** Chemical tankers engaged in the carriage of liquid products with a flash point not exceeding 60 °C (entry "No" in column *i* of the table of minimum requirements in Chapter 17 of the *IBC Code*), irrespective of their gross tonnage, shall be provided with a fixed deck foam fire-extinguishing system in accordance with the requirements specified in 6.12.4.

**6.12.3.2** Chemical tankers fitted with bow or stern loading and unloading arrangements shall be provided with one additional foam monitor in accordance with the requirements specified in paragraph 6.12.4.8 and one additional applicator meeting the requirements specified in paragraph 6.12.4.11. The additional monitor shall be so located as to protect the bow or stern loading and unloading arrangements. The area of the cargo line forward or aft of the cargo area shall be protected by the above-mentioned applicator.

**6.12.3.3** In cargo area, portable fire-extinguishing equipment suitable for the products to be carried shall be provided and kept in good operating order.

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<sup>1)</sup> Bilge high-level alarms are acceptable as an alternative means for the level monitoring devices.

#### 6.12.4 Fixed Deck Foam System

**6.12.4.1** Only one type of foam concentrate shall be supplied, and it shall be effective for the maximum possible number of cargoes intended to be carried. For other cargoes for which foam is not effective or is incompatible, additional arrangements to the satisfaction of PRS shall be provided. Regular protein foam shall not be used.

**6.12.4.2** For liquid cargoes with a flash-point not exceeding 60 °C for which foam is not effective or is incompatible, an alcohol-resistant foam concentrate shall be used in the deck foam extinguishing system. The list of cargoes for which an alcohol-resistant foam concentrate shall be used is contained in the *IBC Code*, (entry "A" in column 1 of the table of minimum requirements in Chapter 17) and MSC/Circ.553.

**6.12.4.3** Alcohol-resistant foam concentrate is subject to type tests in accordance with the guidelines specified in MSC.1/Circ.1312/Corr.1.

**6.12.4.4** The arrangements for providing foam shall be capable of delivering foam to the entire cargo tanks deck area as well as into any cargo tank, the deck of which is assumed to be ruptured.

**6.12.4.5** Deck foam system shall be capable of simple and rapid operation. The main control station for the system shall be suitably located outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fires in the areas protected.

**6.12.4.6** The rate of supply of foam solution shall be not less than the greatest of the following:

- .1** 2 l/min per square metre of the cargo tanks deck area, where cargo tanks deck area means the maximum breadth of the ship times the total longitudinal extent of the cargo tank spaces;
- .2** 20 l/min per square metre of the horizontal sectional area of the single tank having the largest such area; or
- .3** 10 l/min per square metre of the area protected by the largest monitor, such area being entirely forward of the monitor.

Lower application rates may be accepted based on performance tests.

**6.12.4.7** Sufficient foam concentrate shall be supplied to ensure at least 30 min of foam generation when using the highest of the solution rates specified in 6.12.4.6.

For chemical tankers fitted with inert gas systems, a quantity of foam concentrate sufficient for 20 min of foam generation may be accepted.

**6.12.4.8** Foam from the fixed deck foam system shall be supplied by means of monitors and foam applicators. At least 50% of the foam rate required in paragraph 6.12.4.6.1 or 6.12.4.6.2 shall be delivered from each monitor. The capacity of any monitor shall be at least 10 l/min of foam solution per square metre of deck area protected by that monitor, such area being entirely forward of the monitor. Such capacity shall be not less than 1.250 l/min. For chemical tankers of less than 4,000 tonnes deadweight, the minimum capacity of the monitor may be lesser subject to PRS' consent in each particular case.

**6.12.4.9** The distance from the monitor to the farthest extremity of the protected area forward of that monitor shall be not more than 75% of the monitor throw in still air conditions.

**6.12.4.10** A monitor and hose connection for a foam applicator shall be situated both port and starboard at the poop front or accommodation spaces facing the cargo area.

**6.12.4.11** Foam applicators shall be provided for flexibility of action during fire-fighting operations and to cover areas screened from the monitors. The capacity of any applicator shall be not less than 400 l/min and the applicator throw in still air conditions shall be not less than 15 m.

The number of foam applicators provided shall be not less than four. The number and disposition of foam main outlets shall be such that foam from at least two applicators can be directed to any part of the cargo tanks deck area.

**6.12.4.12** Valves shall be provided in the foam main, and in the fire main where this is an integral part of the deck foam system, immediately forward of any monitor position to isolate damaged sections of those mains.

**6.12.4.13** Operation of a deck foam system at its required output shall permit the simultaneous use of the minimum required number of jets of water at the required pressure from the fire main.

**6.12.4.14** Means shall be provided for the crew to safely check the quantity of foam concentrate in the tanks and taking the foam concentrate samples for the periodical checking of its quality. The minimum level/required quantity of foam concentrate shall be marked on the tank.

## **6.12.5 Inert Gas System**

**6.12.5.1** Chemical tankers, irrespective of gross tonnage, engaged in the carriage of flammable products (entry "inert" in column *h* of the table of minimum requirements in Chapter 17 of the *IBC Code*) shall be provided with inert gas system complying with the requirements for inert gas system on chemical tankers contained in Res. A.567(14).

**6.12.5.2** Where an inert gas system based on oil fired inert gas generators is fitted on board chemical tankers, such system shall fulfil the requirements specified in Res. A.567(14) in addition to the requirements specified in paragraphs 6.12.5.3 to 6.12.5.6.

**6.12.5.3** As an alternative to the water seal in the inert gas line on deck, an arrangement consisting of two shut-off valves in series with a venting valve in between may be accepted (double block and bleed). The following conditions apply:

- .1 operation of the valve shall be executed automatically. Signal(s) for opening/closing of valves shall be taken from the process directly, e.g. inert gas flow or differential pressure;
- .2 alarm for faulty operation of the valves shall be provided, e.g. the operation status of "Blower stop" and "supply valve(s) open" is an alarm condition.

**6.12.5.4** Where two blowers are provided, the total capacity of the inert gas system shall preferably be divided equally between the two blowers, and in no case shall one blower have a capacity less than 1/3 of the total capacity required.

**6.12.5.5** Those parts of scrubbers, blowers, non-return devices, scrubber effluent and other drain pipes which may be subjected to corrosive action of the gases and/or liquids shall be either constructed of corrosion resistant material or lined with rubber, glass fibre epoxy resin or other equivalent coating material.

**6.12.5.6** The compartment where any oil fired inert gas generator is situated shall be treated as machinery space of category A in respect of fire protection.

**6.12.5.7** Nitrogen generator systems shall fulfil the requirements specified in 3.10.18.

## **6.12.6 Water Fire Main System**

**6.12.6.1** In chemical tankers, irrespective of their gross tonnage, water fire main system shall fulfil the requirements for cargo ships of 2000 gross tonnage and upwards.

**6.12.6.2** Aluminium alloys shall not be used for fire hose couplings and nozzles in open deck areas.

## **6.12.7 Fire Protection of Machinery Spaces**

Chemical tankers, irrespective of their gross tonnage, shall fulfil the requirements for cargo ships of 2000 gross tonnage and upwards in respect of the fire protection of machinery spaces and fixed fire-extinguishing systems used in such spaces specified in sub-chapter 2.5.

However, the requirements concerning local water spray system installed in machinery spaces of category A above 500 m<sup>3</sup> in volume, given in 2.5.8, are applicable only where the chemical tanker is of gross tonnage 2000 and upwards.



### 6.12.8 Application of Aluminium Coatings

Chemical tankers engaged in the carriage of products with a flash-point not exceeding 60 °C shall fulfil the requirements concerning application of aluminium coatings for the hull and piping specified in 6.3.9.

### 6.12.9 Requirements for Paint Lockers and Store-Rooms for Flammable Liquids

**6.12.9.1** Paint lockers and store-rooms for flammable liquids shall fulfil the requirements specified in 2.8.

**6.12.9.2** Paint lockers, irrespective of their use, shall not be located above the cargo area.

### 6.12.10 Access to Spaces in Cargo Area

Access to forecastle spaces containing sources of ignition is permitted through doors facing the cargo area provided that such doors are located outside explosion-hazardous zones as defined in IEC Publication IEC 60092-502.

### 6.12.11 Crew Protective Clothing and Equipment

Chemical tankers, depending on the type of the carried cargo, shall be provided with suitable protective clothing, breathing apparatus and safety equipment for the protection against noxious chemicals, in accordance with the requirements of the *IBC Code*.

## 6.13 Fire Fighting Ships – Mark: FIRE FIGHTING SHIP . . .

### 6.13.1 Application

**6.13.1.1** The requirements specified in sub-chapter 6.13 are applicable to fire fighting ships and ships having special fire fighting capabilities, intended for fire fighting and rescue operations.

**6.13.1.2** A ship which fulfils the applicable requirements concerning structure and equipment will be assigned an additional mark **FIRE FIGHTING SHIP** and the appropriate notation: **1a** or **1** or **2**, or **3**, affixed to the symbol of class.

**6.13.1.3** Notation **1a** and **1** signifies that a ship is intended for an early stage of fire fighting and rescue operations close to structure on fire.

**6.13.1.4** Notation **2** or **3** signifies that a ship is intended for continuous large fires fighting operations, carried out at a distance of structure on fire.

**6.13.1.5** A ship, which, in addition to compliance with the requirements for **2** or **3** notation assignment, is fitted with the water screen system for self-protection

enabling to carry out fire fighting and rescue operations close to structure on fire, will be assigned an additional mark **FIRE FIGHTING SHIP 2** and **1** or **FIRE FIGHTING SHIP 3** and **1**, respectively.

**6.13.1.6** Detailed requirements concerning particular notations are specified in sub-chapter 6.13.3.

### **6.13.2 General Requirements**

**6.13.2.1** In ships with **1a** or **1** notation, all exterior boundaries, such as: bulkheads, decks and the hull above design summer waterline shall be constructed of steel and shall be protected by the water screen system.

The application rate of the water screen system may be reduced in accordance with the requirements specified in paragraph 6.13.6.3.

**6.13.2.2** In ships with **2** or **3** notation, all exterior boundaries of the hull above design summer waterline shall be A-0 steel structures or shall be constructed of an equivalent material, but they do not need be protected by the water screen system.

**6.13.2.3** In ships with **2** or **3** notation which are not provided with the water screen system, all windows and port lights, except those on the navigation bridge, shall be of A-0 Class standard and shall be fitted with steel covers.

**6.13.2.4** Decks and platforms on which fire fighting monitors are situated, as well as the monitors foundations shall be so designed as to sustain loadings from the water jet reactions, with the monitors operating at the maximum output in the direction most unfavourable to the stability of the ship.

**6.13.2.5** Ships shall have adequate stability for all modes of fire fighting operations with all water and foam monitors in operation in the direction most unfavourable to the stability of the ship (operation in horizontal plane, at the maximum output in the direction towards one side and the minimum oil fuel and water capacity).

**6.13.2.6** Ships shall have adequate manoeuvrability to enable it to keep position during fire-fighting and rescue operations.

**6.13.2.7** Ships lighting shall be such as to facilitate fire-fighting and rescue operations at night.

Two searchlights shall be provided on board, capable of giving an effective horizontal and vertical range of coverage and an illumination to a distance of 250 m in clear air at a minimum level of illumination of 50 lux within an area not less than 11 m in diameter.

**6.13.2.8** Ships shall be provided with oil fuel storage tanks ensuring the ship propulsion and fire-extinguishing equipment operation during fire fighting

operations depending on the additional notation affixed to the symbol of class in accordance with the Table 6.13.3, item 11.

**6.13.2.9** Classification documentation, in addition to that required in 1.4.1, shall contain:

- .1 specification containing data on all functions of the ship, i.e. fire-fighting and rescue operations, fire-extinguishing systems operation, including the data on fire-fighting appliances and equipment;
- .2 calculations of the ship stability for all operation modes of water and foam monitors with monitors operating in the direction most unfavourable to the ship stability;
- .3 calculations of water and foam monitors supports at the most unfavourable mode of operation;
- .4 calculations of: fire-extinguishing system with water monitors, fire-extinguishing system with foam monitors and water screen system;
- .5 plan showing the arrangement and securing of fire fighting appliances and equipment (pumps, water and foam monitors, foam concentrate containers, fire hoses manifolds);
- .6 plan of fire control room, where provided;
- .7 plans and diagrams of fire-extinguishing systems: fire-extinguishing system with water monitors, fire-extinguishing system with foam monitors and the water screen system;
- .8 arrangement plan of fire-fighting equipment and fire-fighter's outfit;
- .9 water and foam monitors remote control plan;
- .10 plan of the electric lighting arrangement and supply;
- .11 plan of the compressed air system for charging the bottles of breathing apparatus;
- .12 arrangement plan showing sea chests for fire pumps.

**6.13.2.10** Ships and fire-extinguishing systems are subject to the following tests:

- .1 test of the ship manoeuvrability and keeping its position during the operation of all monitors in fire fighting simulation conditions;
- .2 measurement of the ship angle of list during operation of all water and foam monitors directed to one side;
- .3 operation test of water pumps at maximum output (pressure, capacity);
- .4 operation test of water and foam monitors at maximum output;
- .5 measurement of horizontal and vertical range of water and foam monitors;
- .6 checking the operation and the measurement of the water screen system capacity;
- .7 operation test of ship lighting at night; checking the searchlights reflectors operation.

**6.13.2.11** Fire water pumps and their prime movers, as well as air compressors for charging the cylinders of the breathing apparatus shall be supplied with the PRS Certificate.

**6.13.2.12** The following fire-fighting appliances and equipment shall be supplied with Type Approval Certificate.

- .1 water and foam monitors;
- .2 foam concentrate;
- .3 foam concentrate proportioners and high-expansion foam generators;
- .4 fire hydrants, nozzles and fire hoses;
- .5 water screen spraying nozzles;
- .6 fire-fighter's outfit;
- .7 portable high-expansion foam generators;
- .8 searchlight reflectors.

**6.13.2.13** Operation manual containing the following information shall be available on board:

- .1 instructions for the ship operation during all modes of fire fighting and rescue operations;
- .2 diagrams and operation description of all fire-extinguishing systems;
- .3 instructions for use, periodical testing and maintenance of all fire-extinguishing systems and appliances.

### 6.13.3 Required Equipment

Depending on the additional notation affixed to the symbol of class, the ship shall fulfil the relevant requirements specified in Table 6.13.3.

**Table 6.13.3**  
**Requirements for fire fighting ship equipment**

Item	Requirement	Notation affixed to the symbol of class			
		1a	1	2	3
1	2	3	4	5	6
1	Number of water monitors	2÷4	2	3 or 4	4
2	Water monitor capacity [m <sup>3</sup> /h]	90÷300	1200	2400 or 1800	2400
3	Number of water pumps	1÷2	1÷2	2÷4	2÷4
4	Total capacity of water pumps [m <sup>3</sup> /h]	600	2400	7200	9600
5	Number of foam monitors	2÷4	–	–	2
6	Foam monitor capacity [m <sup>3</sup> /h]	40	–	–	300
7	Horizontal range of water monitor <sup>1)</sup> [m]	–	120	150	150
8	Vertical range of water monitor <sup>2)</sup> [m]	–	50	70	70
9	Vertical range of foam monitor <sup>3)</sup> [m]	–	–	–	50
10	Water screen system for ship self protection	+ <sup>5)</sup>	+ <sup>5)</sup>	–	–

1	2	3	4	5	6
11	Oil fuel capacity sufficient for fire fighting operations, for a given time <sup>4)</sup> [h]	–	24	96	96
12	Number of hose connections at each side of ship	–	4	8	8
13	Number of fire-fighter's outfits	–	4	8	8
14	Portable high-expansion foam generator	–	–	1	1

**Notes:**

- 1) Length of monitor throw measured horizontally from the monitor outlet to the mean impact area.
- 2) Height of throw measured vertically from the sea level to mean impact area at a horizontal distance of at least 70 m from the nearest part of the ship.
- 3) Height of foam monitor throw measured vertically from the sea level during two monitors simultaneous operation, at maximum output capacity.
- 4) Total oil fuel capacity on board shall be such as to ensure the propulsion operation and continuous operation of all monitors, at maximum output for a specified time.
- 5) Water screen system to be provided; for detailed requirements – see 6.13.6.

**6.13.4 Water Monitor Fire-Extinguishing System (for External Objects)**

**6.13.4.1** The number and capacity of water monitors and pumps, depending on additional notation affixed to the symbol of class, shall be in accordance with Table 6.13.3.

**6.13.4.2** Water monitors shall be so arranged forward or aft as to ensure their most effective operation. The monitors shall be so positioned that they will have a free line for the water jet over the horizontal area covered. The monitors shall be capable of adequate adjustment in the vertical and horizontal direction; the required range and height of trajectory shall be achieved with all monitors operating simultaneously.

**6.13.4.3** Water monitors shall give solid jets of water. In ships with **2** and **3** notations, at least two monitors shall be capable of giving dispersed water jet.

**6.13.4.4** Monitor position blocking arrangements shall be provided to prevent water jets from impinging on the ship's structure or equipment.

**6.13.4.5** Monitors shall be capable of being operated both locally and at the remote control station. The remote control station shall have adequate overall operational visibility, means of communication and fire protection.

The remote control station shall be fitted with water pumps control buttons, pressure gauges and shut-off control valves.

**6.13.4.6** Valve control shall be so designed as to avoid water hammer.

**6.13.4.7** Monitor remote control system shall be suitably protected against external damage. Electrical control system shall be provided with overload and

short-circuit protection. Where a hydraulic or pneumatic monitor control system is applied, the control power units shall be duplicated. Control equipment shall be clearly marked.

**6.13.4.8** Water monitor pumps may be used for the supply of the screen water system and foam monitor fire-extinguishing system. In those cases, the capacity of the pumps shall be adequately increased and shut-off valves enabling disconnection of the water supply to the systems shall be provided.

**6.13.4.9** Fire pumps shall be supplied from an independent sea water suction valve, which shall not be used for any other purposes. Sea chest shall be arranged as low as practicable to avoid clogging due to debris or ice. The location of sea chest shall be such that the water suction will be possible in any ship operation conditions. Due regard shall be paid to the ship's motions on wave and water flow from propellers or thrusters.

**6.13.4.10** All sea chests shall be provided with strainer plates at the ship's shell plating. The strainer plates shall have a clear area of at least twice that of the sea valves. Low pressure steam or compressed air shall be provided for cleaning the strainer plates.

**6.13.4.11** Sea valves shall be operable from fire pump control position.

**6.13.4.12** Sea valves with nominal diameter exceeding 450 mm shall be power and manually controlled.

**6.13.4.13** Spaces where fire pumps and their prime movers are located shall be considered as machinery spaces in respect of fire protection.

**6.13.4.14** Piping system shall be protected against overpressure.

**6.13.4.15** All piping shall be made of steel and shall be protected both internally and externally against corrosion by hot galvanizing.

**6.13.4.16** Drain plugs for water drainage shall be installed in the lowest section of the piping.

**6.13.4.17** The piping system shall be protected against operation of the pumps when water inlet valves are closed or shall be provided with alarms indicating such operation status of the pumps.

**6.13.4.18** The piping system shall have arrangements to avoid overheating of the pumps at low delivery application rates.

**6.13.4.19** Suction lines shall be as short and straight as practicable. The water velocity in the suction lines shall not exceed 2 m/s.; the water velocity in piping between pumps and water monitors shall not exceed 3.5 m/s.

### **6.13.5 Foam Monitor Fire-Extinguishing System (for Protection of External Objects)**

**6.13.5.1** The number and capacity of foam monitors and the monitors operation characteristics shall be in accordance with Table 6.13.3. The low-expansion foam ratio of the monitors shall be 12 to 1.

**6.13.5.2** Foam monitor system shall consist of foam concentrate container, foam mixing unit and pipelines to the foam monitors.

**6.13.5.3** The foam concentrate container shall have capacity sufficient for at least 30 minutes of foam generation by all monitors.

**6.13.5.4** Means shall be provided for the crew to safely check the quantity of foam concentrate in the tanks and taking the foam concentrate samples for the periodical checking of its quality. The minimum level/required quantity of foam concentrate shall be marked on the tank.

**6.13.5.5** Water supply to the foam monitor system may be taken from water monitor system pumps after appropriately reducing the supply water pressure.

**6.13.5.6** Foam monitors shall have both local and remote control. The remote control of the foam monitors shall be located at the remote control station for the water monitors. The remote control shall include water pumps operation and water and foam concentrate valves control.

**6.13.5.7** Monitor remote control system shall fulfil the requirements specified in paragraph 6.13.4.7.

### **6.13.6 Water Screen System**

**6.13.6.1** Water screen system shall provide protection to all external vertical areas of the hull, superstructures and deckhouses, including water and foam monitor foundations and equipment, as well as the surface of the deck above machinery spaces or other spaces in which combustible materials are located. During water screen system operation, proper visibility from the navigation bridge and from fire control room shall be provided.

**6.13.6.2** Water screen system shall be provided with sea water pump or may be served by water monitor system pump, provided the pump capacity is increased by the capacity required for the water screen system.

**6.13.6.3** Capacity of the water screen system shall be at least 5 l/min/m<sup>2</sup> for A-60 Class boundaries and 10 l/min/m<sup>2</sup> for the remaining boundaries and decks.

**6.13.6.4** Water screen system shall be divided into sections so that it will be possible to close down manually or remotely sections covering boundaries which are not exposed to fire.

**6.13.6.5** Pump capacity shall be sufficient to supply simultaneously, at the required pressure, all nozzles of the sections which protect the largest area exposed to fire and high temperature.

**6.13.6.6** Arrangement of the nozzles shall be such as to give an even distribution of water spray over the protected area, as well as to preclude damage thereto during fire fighting operations.

**6.13.6.7** Piping shall be made from steel and be protected against corrosion externally and internally by hot galvanizing or shall be made from other corrosion and heat resistant metal alloys. Drain plugs for water drainage shall be installed in the lowest sections of the pipes.

**6.13.6.8** Decks shall be provided with scuppers for water draining during water screen system operation.

### **6.13.7 Fire Hose Stations (for Protection of External Objects)**

**6.13.7.1** Ship shall be provided with fire hose stations for fire fighting on external objects. The number of fire hose connections, in a fire hose station, on each side of the ship shall be in accordance with Table 6.13.3.

**6.13.7.2** At least half of the required number of fire hose connections shall be located on the open deck on both sides.

**6.13.7.3** Nominal diameter of fire hoses shall be not less than 38 mm and not more than 65 mm.

**6.13.7.4** Nozzles shall be of universal type, i.e. they shall give solid or dispersed water jet and shall ensure a water jet throw not less than 12 m.

**6.13.7.5** Where a fire hose station is supplied from the water monitor system, provision shall be made to reduce the water pressure at the hydrants to an amount at which each fire hose nozzle can be safely handled by one man.

### **6.13.8 Fire-Fighter's Outfit**

**6.13.8.1** Fire-fighter's outfit shall consist of personal equipment and breathing apparatus, with two spare air bottles. Fire-fighter's outfit shall comply with the requirements specified 5.1.4. The number of fire-fighter's outfits for fire fighting operations, depending on notation affixed to the symbol of class, shall be in accordance with Table 6.13.3.



**6.13.8.2** Fire-fighter's outfits shall be stored in at least 2 rooms, one of which shall be accessible from the open deck. The entrance to the room shall be clearly marked. The room shall be provided with ventilation and heating arrangements.

**6.13.8.3** The arrangement of the room shall enable easy access to the whole stored outfit. Protective clothing and other outfits shall be stored in suspended position.

**6.13.8.4** An air compressor capable of recharging the air bottles used in breathing apparatus, having the capacity of at least 75 l/min, shall be provided. The inlet to the compressor shall be fitted with appropriate filters. The air compressor may be located in the fire-fighter's outfit room or in a separate space, located in a safe place.

### **6.13.9 Portable High-Expansion Foam Generator (for Protection of External Objects)**

**6.13.9.1** Capacity of high-expansion foam generator intended for fire fighting operations on external objects, required on ships with additional class 2 or 3 notation affixed to the symbol of class shall be not less than 100 m<sup>3</sup>/min.

**6.13.9.2** Foam concentrate shall be stored in portable tanks. The total storing foam concentrate capacity shall be sufficient for at least 30 minutes of foam generation.

## **6.14 High Speed Craft – Mark: HSC**

High speed craft shall fulfil the requirements of the *HSC Code*, as amended.

## **6.15 Ships with Ice Class – Marks: L1A, L1, L2, L3 and L4**

### **6.15.1 General Requirements**

Components of fire-fighting systems and other fire protection equipment which may be exposed to icing which could interfere with the proper functioning of that component shall be protected adequately.

### **6.15.2 Means of Escape**

External stairways, ladders and landings on the escape routes from accommodation and service spaces to assembly stations and life saving equipment exposed to sub-zero temperatures shall be so arranged and protected that they are not made inaccessible or inoperable by ice or snow accumulation.

### **6.15.3 Water Fire-Extinguishing Systems**

**6.15.3.1** On ships with ice class notation, at least one of the water fire main system pumps and pumps serving other water fire-extinguishing systems, required

in the present Part of the *Rules*, shall be connected to a sea chest which is provided with de-icing arrangements, complying with the requirements specified in 22.2.11, *Part VI – Machinery Installations and Refrigerating Plants*.

**6.15.3.2** Where a fixed fire-extinguishing system or alternative fire-extinguishing system situated in a space separate from the compartment containing the main fire pumps utilizes its own independent sea chest, this sea chest should be capable of being cleared of accumulations of slush ice, by steam or compressed air.

**6.15.3.3** Fire pumps including an emergency fire pump shall be installed in heated compartments and in any event shall be adequately protected from freezing for minimum temperature for the intended voyage.

**6.15.3.4** Open deck isolating valves of water fire main system shall be so located that they are accessible. Any isolating valves located in exposed positions shall not be subjected to icing from freezing spray.

**6.15.3.5** In the case of systems which need not be permanently pressurized, the fire main shall be so arranged that external sections subjected to freezing can be isolated and draining devices shall be provided. The system control shall be fitted with a plate informing of the necessity to drain the pipes any time the system has been used.

**6.15.3.6** In the case of systems required to be permanently pressurized, the pipes shall be led in heated compartments. The pipes led on the open deck or in compartments with minus temperatures shall be adequately protected against freezing.

**6.15.3.7** Hydrants positioned on open decks shall be installed in boxes to protect them against being flooded and freezing. Each hydrant shall be equipped with an efficient two-handed valve handle.

#### **6.15.4 Fixed Gas Fire-Extinguishing Systems**

**6.15.4.1** Fixed gas fire-extinguishing systems shall be so designed and located that they are not made inaccessible or inoperable by ice or snow accumulation or low temperature.

Closing arrangements for openings of the spaces protected by gas fire-extinguishing systems which may be subjected to low temperatures and freezing shall be protected adequately.

**6.15.4.2** Stations containing fire-extinguishing medium shall be located in adequately heated compartments and the access facing an open deck shall be so shielded that the door will not be made inoperable due to freezing or snow accumulation.

**6.15.4.3** Precautions shall be taken to prevent fire-extinguishing medium pipings, isolating valves and nozzles of any fire-extinguishing system located in spaces to be subject to negative temperatures from becoming clogged by ice build up or freezing.

**6.15.4.4** External terminals of relief valves and safety valves of the fire-extinguishing medium piping and tanks shall be adequately protected from becoming clogged due to freezing or snow accumulation.

### **6.15.5 Fire-Fighting Equipment**

Foam fire-extinguishers shall not be located in any positions that are exposed to freezing temperatures.

## **6.16 Ships with Unattended Machinery Space and with One Person on Watch – Mark: AUT and NAV 1**

### **6.16.1 Water Fire Main System**

On ships with unattended machinery space or when only one person is required on watch, there shall be immediate water delivery from the fire main system at a suitable pressure, either by remote starting of one of fire pumps from the navigation bridge and fire control station, if any, or permanent pressurisation of the fire main system by one of the main fire pumps.

On cargo ships of less than 1600 gross tonnage, the remote starting of the pump need not be provided if the fire pump start button in the machinery space is in an easily accessible position.

### **6.16.2 Fire Detection and Alarm System in Machinery Spaces**

**6.16.2.1** Machinery spaces of category A shall be provided with fire detection and fire alarm system complying with the applicable requirements specified in 4.1 and in the present sub-chapter.

**6.16.2.2** Fire control panel shall be located on the navigating bridge, in fire control station or other accessible place where a fire in the machinery space will not render it inoperative.

**6.16.2.3** Fire control panel shall indicate the place of the detected fire in accordance with the arranged fire zones by means of a visual signal. Audible signals clearly distinguishable in character from any other audible signals shall be audible throughout the navigating bridge and the accommodation area of the personnel responsible for the operation of the machinery space.

**6.16.2.4** Fire detectors shall be of types, and so located as to rapidly detect the onset of fire in conditions normally present in the machinery space and at variations of ventilation as required by the possible range of ambient temperature.

Consideration shall be given to avoiding false alarms. Combination of detector types shall apply in order to enable the system to react to more than one type of fire symptom.

One type of fire detectors shall react to flame. Such detectors shall be located in the region of internal combustion engines, boiler firing and other places subject to open fire. The type and positioning of fire detectors is subject to PRS' approval in each particular case.

**6.16.2.5** Fire detector zones shall be arranged in a manner that will enable the operating staff to locate the seat of the fire. Air currents created by the machinery are not to render the detection system ineffective. The arrangement and number of loops, as well as location of detector heads is subject to PRS' approval in each particular case.

**6.16.2.6** Where fire detectors are provided with the means to adjust their sensitivity, necessary arrangements shall be ensured to fix and identify the set point.

**6.16.2.7** Where it is intended that a particular loop or detector may be temporarily switched off, this state shall be clearly indicated. Reactivation of the loop or detector shall be performed automatically after a present time.

**6.16.2.8** Manually operated control points shall be located in the following places:

- passageways having entrances to machinery spaces of category A;
- control station in the machinery space.

**6.16.2.9** After the fire detection and alarm system has been installed on board the ship, operation tests shall be performed in various operating conditions of ventilation and machinery installations in accordance with the test programme approved by PRS.

**6.16.2.10** With regard to power supply, safety devices, selection and routing of cables, fire detection and alarm system shall fulfil the requirements specified in sub-chapter 7.5, *Part VIII – Electrical Installations and Control Systems*.

### **6.16.3 Fire-Extinguishing Systems in Machinery Spaces**

**6.16.3.1** In spaces containing steam turbines or enclosed steam engines used for main propulsion or other purposes having in the aggregate a total output of not less than 375 kW, one of the fixed total flooding fire-extinguishing systems, referred to in 2.5.1.1, shall be provided.

**6.16.3.2** Local water-based spraying fire-extinguishing system, required in 2.5.8, shall be operated automatically. The requirements for automatic operation are specified in *Publication No. 89/P*.

#### **6.16.4 Portable Fire-Extinguishers**

One portable fire-extinguisher shall be provided at each entrance to machinery spaces of category A.

#### **6.16.5 Early Detection of Fire in Machinery Spaces**

**6.16.5.1** Means shall be provided to detect and give alarms at an early stage in case of fires:

- .1 in boiler air supply casings and exhausts (uptakes); and
  - .2 in scavenging air belts of propulsion machinery,
- unless PRS deems this to be unnecessary.

**6.16.5.2** Internal combustion engines of 2,250 kW and above or having cylinders of more than 300 mm bore shall be provided with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices.

#### **6.17 Restricted Service Ships – Marks: I, II and III**

**6.17.1** In cargo spaces of passenger ships, a fixed gas fire-extinguishing system required in 6.1.12.1 need not be provided if the ship is fitted with steel hatch covers and effective means of closing all ventilators and other openings leading to the cargo spaces.

**6.17.2** In cargo spaces of passenger ships, fire detection and fire alarm system, required in 6.1.12.3, need not be applied.

#### **6.18 Ships Carrying Vehicles with Petroleum Tanks – Mark: PET**

Cargo ships shall comply with the requirements for the protection of ro-ro spaces and vehicles spaces, specified in 6.2.2, whereas passenger ships – the requirements for fire protection of special category spaces and ro-ro spaces specified in 6.10.2.

#### **6.19 Ships Provided with Inert Gas System – Mark: ING**

Inert gas system installed on board the ship assigned the additional mark **ING** shall fulfil the requirements specified in sub-chapter 3.10.

#### **6.20 Passenger Ships Engaged on Domestic Voyages – Mark: Class B, Class C or Class D**

The requirements specified in the present sub-chapter apply to passenger ships engaged on domestic voyages and are supplementary to the requirements specified in sub-chapters 6.1 and 6.10.

These requirements also apply to ships of less than 24 metres in length.

## **6.20.1 Water Fire Main System**

### **6.20.1.1 Ships with Length of 24 Metres and Above**

#### **6.20.1.1.1 The number of fire pumps and the pressure in the system shall be as follows:**

- .1** in ships carrying not more than 500 passengers:
  - minimum number of pumps – not less than two, one of which may be a main engine-driven pump;
  - minimum pressure maintained at all hydrants – not less than 0.3 MPa (only for ships with Class B mark).
- .2** in ships carrying more than 500 passengers:
  - minimum number of pumps – not less than three, one of which may be a main engine-driven pump;
  - minimum pressure maintained at all hydrants – not less than 0.4 MPa (only for ships with Class B mark).

In ships carrying more than 250 passengers, the arrangement of sea connections, fire pumps and their sources of power shall be such as to ensure that, in the event of fire in any one compartment, all the fire pumps will not be put out of action.

If this requirement cannot be fulfilled, an emergency fire pump in accordance with the requirements specified in 3.2.4 shall be provided.

In ships carrying more than 250 passengers, the arrangements for the ready availability of water supply shall be such that at least one effective jet of water is immediately available from any hydrant in an interior location and so as to ensure the continuation of the output of water by the automatic starting of a required fire pump.

### **6.20.1.2 Ships with Class C or Class D Additional Notation of Less than 24 Metres in Length**

**6.20.1.2.1** One independent fire pump is required, which shall be capable of delivering for fire-fighting purposes at least one jet of water from any fire hydrant, at the pressure specified below. The quantity of water so delivered shall not be less than two thirds of the quantity required to be dealt with by the bilge pumps when employed for bilge pumping.

Such fire pump shall be capable, when discharging the maximum amount referred to above through fire hydrants with nozzles of 12 or 16 or 19 mm, of maintaining at any hydrant minimum pressure of 0.3 MPa.

**6.20.1.2.2** Every ship carrying over 250 passengers shall be provided with an additional fire pump which shall be permanently connected to the fire main. Such a pump shall be powered independently. Such a pump and its source of power shall not be situated in the same compartment as the pump required in accordance with 6.20.1.2.1 and shall be provided with a permanent sea connection situated outside the

machinery space. Such pump shall be capable of delivering at least one jet of water from any fire hydrants provided in the ship maintaining a pressure of at least 0.3 MPa.

**6.20.1.2.3** In ships with a periodically unattended machinery space or when only one person is required on watch, there shall 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 by automatic start of the pump on the pressure drop in the system..

## **6.20.2 Protection of Machinery Spaces**

### **6.20.2.1 Ships with Length of 24 Metres and Above**

**6.20.2.1.1** Machinery spaces of category A above 500 m<sup>3</sup> in volume (irrespective of the ship's gross tonnage), shall, in addition to the fixed fire-extinguishing system required in 2.5.1.1, be protected by a type-approved local spraying water-based system or equivalent fire-fighting system, of approved type, complying with the requirements specified in 3.4.6.

**6.20.2.1.2** In ships carrying more than 400 passengers, machinery spaces of category A (irrespective of the machinery space volume), shall, in addition to the fixed fire-extinguishing system required in sub-chapter 2.5.1.1, be protected by a type-approved local spraying water-based system or equivalent fire-fighting system, of approved type, complying with the requirements specified in 3.4.6.

**6.20.2.1.3** In ships of 40 metres in length and above, within the machinery spaces, emergency escape breathing devices in accordance with the requirements specified in 5.1.5 shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of fire. The location of emergency escape breathing devices shall take account of the layout of the machinery space and the number of persons normally working in the space.

**6.20.2.1.4** The number and location of these devices shall be indicated on the *Fire Control Plan* required in 6.20.5.1.

### **6.20.2.2 Ships with Class B, Class C or Class D Additional Notation of Less than 24 metres in Length**

Machinery space of category A shall be fitted with:

- .1** a fixed total flooding fire-extinguishing systems (e.g. carbon dioxide) complying with the requirements specified in 3.6 or an equivalent gas fire-extinguishing system;
- .2** one mobile foam fire extinguisher of at least 45 l capacity or one carbon dioxide extinguisher of at least 16 kg capacity provided in any space containing internal combustion engines, oil settling tanks or oil fuel units. The fire extinguisher may be positioned outside the machinery space at the entrance;

- 3** 9 l foam fire extinguishers or equivalent – one extinguisher per each 736 kW, or part thereof, of the combined output of such machinery; it is required that not fewer than two but not more than six such extinguishers shall be provided in any such space. The use of low-expansion foam fire-extinguishing system in lieu of the fire extinguishers is permitted.

### **6.20.3 Automatic Sprinkler System**

For ships with additional notation Class C or Class D of less than 40 metres in length with a total protected area of less than 280 m<sup>2</sup>, PRS may accept other area for sizing of pumps and alternative supply components than those required in 3.3.4.2.

### **6.20.4 Fire-Fighter's Outfit**

**6.20.4.1** In ships of 40 metres in length and above, at least two fire-fighter's outfits in accordance with the requirements specified in 5.1.4 shall be provided.

**6.20.4.2** In ships of 60 metres in length and above, if the aggregate of the lengths of all passenger spaces and service spaces on the deck which carries such spaces is more than 80 metres or, if there is more than one such deck, on the deck which has the largest aggregate of such lengths, at least two fire-fighter's outfits and at least two sets of personal equipment for every 80 metres, or part thereof, of such aggregate of lengths shall be additionally provided.

In ships carrying more than 36 passengers, two additional fire-fighter's outfits shall be provided for each main vertical zone, except for stairway enclosures which constitute individual main vertical zones and for main vertical zones of limited length in the fore and aft end of a ship which do not include machinery spaces or main galleys.

**6.20.4.3** In ships of 40 metres in length and above, but less than 60 metres, at least two fire-fighter's outfits shall be provided.

**6.20.4.4** In ships with additional notation Class B of less than 40 metres in length, at least two fire-fighter's outfits shall be provided, but with only one spare air-charge for self-contained breathing apparatus.

**6.20.4.5** If – taking account of the ship service restrictions – PRS deems it unreasonable or impracticable to place a fire-fighter's outfit on board, the ship may be exempt from the requirements to carry one or more such outfits.

### **6.20.5 Operation Documentation**

**6.20.5.1** Ships shall be provided with the *Fire Control Plan* complying with the requirements specified in 1.4.2.



**6.20.5.2** Ships shall be provided with the *Fire Protection Systems and Appliances Maintenance Plan* complying with the requirements specified in 1.4.3.2, as well as the *Fire Training Manual* complying with the requirements specified in 1.4.3.3.

**6.20.5.3** In ships carrying cargo, to provide information and instruction for proper ship and cargo handling operations in relation to fire safety, *Fire Safety Operational Booklet* complying with the relevant requirements specified in 1.4.3.4 shall be carried.

**6.20.6 Ship Structure, Main Vertical and Horizontal Zones,  
as well as Bulkheads within these Zones**

**6.20.6.1** The hull, superstructure, structural bulkheads, decks and deckhouses shall be constructed of steel or steel equivalent material.

**6.20.6.2** In ships carrying more than 36 passengers, the hull, superstructure and deckhouses shall be subdivided into main vertical zones by A-60 Class divisions.

Steps and recesses shall be kept to a minimum, but where they are necessary, they shall also be A-60 Class divisions.

Where an open deck space, a sanitary or similar space or a tank including a fuel oil tank, void space or auxiliary machinery space having little or no fire risk, is on one side or where fuel oil tanks are on both sides of the division, the standard may be reduced to A-0.

**6.20.6.3** In ships carrying not more than 36 passengers, the hull, superstructure and deckhouses in way of accommodation and service spaces shall be subdivided into main vertical zones by A Class divisions. These divisions shall have insulation values in accordance with Table 6.1.5-1.

**6.20.6.4** In ships carrying more than 36 passengers, main fire zones divisions shall comply with the requirements specified in 6.1.2.2 to 6.1.2.6.

**6.20.6.5** In ships carrying more than 36 passengers, fire integrity of vertical and horizontal divisions within main fire zones shall comply with the requirements specified 6.1.4.

**6.20.6.6** In ships carrying not more than 36 passengers, fire integrity of vertical and horizontal divisions within main fire zones shall comply with the requirements specified 6.1.5.

**6.20.7 Means of Escape**

**6.20.7.1** The requirements specified in 6.1.6 shall be fulfilled, except for the requirement set forth in 6.1.6.9 regarding the development of the *Means of Escape Plan* for the ship.

**6.20.7.2** In ships of 40 metres in length and above, at least two emergency escape breathing devices in accordance with the requirements specified in 5.1.5 shall be provided in each main vertical zone.

**6.20.7.3** In ships carrying more than 36 passengers, two emergency escape breathing devices, in addition to those required in 6.20.7.2, shall be provided in each main vertical zone

**6.20.7.4** The requirements specified in 6.20.7.2 and 6.20.7.3 do not apply to stairway enclosures which constitute individual main vertical zones or the main vertical zones in the fore or aft end of a ship, which do not contain spaces of categories (6), (7), (8) or (12) defined in 6.1.4.

**6.20.7.5** In ships of less than 24 metres in length, the requirement concerning one of the means of escape from the machinery spaces may be waived having regard to the width and arrangement of the upper part of such space.

### **6.20.8 Means of Escape on Passenger Ro-ro Ships**

The requirements specified in 6.10.1.1 to 6.10.1.4 shall be fulfilled, except that evacuation analysis, referred to in 6.10.1.4, need not be performed in accordance with the IMO guidelines.

### **6.20.9 Openings in A and B Class Divisions**

**6.20.9.1** The requirements specified in 2.2.6.5, 6.1.8.3, 6.1.8.6 and 6.1.9.3, as well as the requirements specified in the present sub-chapter shall be fulfilled.

**6.20.9.2** All openings in A Class divisions shall be provided with permanently attached means of closing which shall have the same fire resistance as the divisions in which they are fitted.

**6.20.9.3** The construction of all doors and door frames in A Class divisions, with the means of securing them when closed, shall provide resistance to fire, as well as to the passage of smoke and flame, as far as practicable, equivalent to that of the bulkheads in which the doors are situated. Such doors and doorframes shall be constructed of steel or other equivalent material. Watertight doors need not be insulated.

**6.20.9.4** The requirement for A Class integrity of the outer boundaries of a ship shall not apply to glass partitions, windows and sidescuttles, provided that in sub-chapter 6.20.12 relating to windows and sidescuttles there is no requirement for such boundaries to have A Class integrity.

This requirement does not apply to exterior doors, except for the doors in superstructures and deckhouses facing life-saving appliances, embarkation and external assembly station areas, external stairs and open decks used for escape routes. Stairway enclosure doors need not meet this requirement.

**6.20.9.5** Doors and door frames in B Class divisions and means of securing them shall provide a method of closure which shall have resistance to fire equivalent to that of the divisions, except that ventilation openings may be permitted in the lower portion of such doors. Where such opening is in or under a door, the total net area of any such opening or openings shall not exceed 0.05 m<sup>2</sup>. 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<sup>2</sup>. All ventilation openings shall be fitted with a grill made of non-combustible material. Doors shall be non-combustible.

**6.20.9.6** For reasons of noise reduction, doors with built-in ventilation soundlocks with openings at the bottom on one side of the door and at the top on the other side may be approved as an equivalent, on condition that the following requirements have been fulfilled:

- .1 the upper opening shall always face the corridor and shall be provided with a grating of non-combustible material and an automatically operating fire damper, activated at a temperature of about 70 °C;
- .2 the lower opening shall be provided with a grating made of a non-combustible material;
- .3 the doors shall be tested in accordance with IMO Resolution A.754 (18) or *FTP Code*, Annex 1, Part 3.

**6.20.9.7** Cabin doors in B Class divisions shall be of a self-closing type. Hold-backs are not permitted.

#### **6.20.10 Protection of Stairways and Lifts in Accommodation and Service Spaces**

The requirements specified in 6.1.7 and 6.1.6.10.3 shall be fulfilled.

#### **6.20.11 Fire Protection of Exhaust Ducts from Galley Range**

**6.20.11.1** In ships carrying more than 36 passengers, exhaust ducts from galley ranges in which grease or fat is likely to accumulate shall meet the requirements specified in 6.1.17.2.

**6.20.11.2** In ships carrying not more than 36 passengers, exhaust ducts from galley ranges passing through accommodation spaces or spaces containing combustible materials shall meet the requirements specified in 2.7.1.

#### **6.20.12 Windows and Sidescuttles**

**6.20.12.1** The requirements specified in 6.1.10.1 and 6.1.10.2 shall be fulfilled.

**6.20.12.2** In ships carrying more than 36 passengers, windows facing life-saving appliances, embarkation and assembly areas, external stairs and open decks used for escape routes, and windows situated below liferaft and escape slide embarkation

areas shall have the fire integrity as required in Table 6.1.4-1. Where automatic dedicated sprinkler heads are provided for these windows, A-0 windows may be accepted as equivalent. Sprinkler heads must be either:

- .1 dedicated heads located above the windows and installed in addition to the conventional ceiling sprinklers; or;
- .2 conventional ceiling sprinkler heads so arranged that the window is protected by an average application rate of at least 5 litres/m<sup>2</sup> per minute and the additional window area is included in the calculation of the area of coverage.

Windows located in the ship's side below the lifeboat embarkation areas shall have the fire integrity at least equal to A-0 Class. In ships carrying not more than 36 passengers, notwithstanding the requirements relating to fire integrity given in Tables 6.1.5-1 and 6.1.5-2, special attention shall be given to the fire integrity of windows facing open or enclosed lifeboat and liferaft embarkation areas and to the fire integrity of windows situated below such areas in such a position that their failure during a fire would impede the launching of, or embarkation into, lifeboats or liferafts.

### **6.20.13 Restricted Use of Combustible Materials**

**6.20.13.1** Except in cargo spaces, mail rooms, baggage rooms or refrigerated compartments of service spaces, all linings, grounds, draught stops, ceilings and insulation shall be of non-combustible materials. Partial bulkheads or decks used to subdivide a space for utility or artistic treatment shall also be of non-combustible material.

**6.20.13.2** Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of piping and pipe fittings for cold service systems need not be non-combustible, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame-spread characteristics.

**6.20.13.3** The following surfaces shall have low flame-spread characteristics:

- .1 exposed surfaces in corridors and stairway enclosures, as well as bulkheads, wall and ceiling linings in all accommodation spaces, service spaces and control stations;
- .2 concealed or inaccessible spaces in accommodation spaces, service spaces and control stations.

**6.20.13.4** Total volume of combustible facings, mouldings, decorations and veneers in accommodation and service spaces shall not exceed a volume equivalent to 2.5 mm veneer on the combined area of the walls and ceilings. Furniture fixed to linings, bulkheads or decks need not be included in the calculation of the total volume of combustible materials.

In the case of ships fitted with the sprinkler system in accordance with the requirements of 3.3, the above volume may include some combustible material used for erection of C Class divisions.

**6.20.13.5** Veneers used on surfaces and linings covered by the requirements of 6.20.13.3 shall have  $Q$  calorific value not exceeding  $45 \text{ MJ/m}^2$  of the area for the thickness used.

**6.20.13.6** Furniture in stairway enclosures shall be limited to seating. It shall be fixed, limited to six seats on each deck in each stairway enclosure, be of restricted fire risk, and shall not restrict the passenger escape route. Additional seating in the main reception area within a stairway enclosure if it is fixed, non-combustible and does not restrict the passenger escape route is permitted.

Furniture is not permitted in passenger and crew corridors forming escape routes in cabin areas. However, lockers of non-combustible material, providing storage for the required safety equipment, may be permitted.

Drinking water dispensers and ice cube machines may be permitted in corridors, provided they are fixed and do not restrict the width of the escape routes. This also applies to decorative flower or plant arrangements, statues or other objects of art, such as paintings and tapestries in corridors and stairways.

**6.20.13.7** Paints, varnishes and other finishes used on exposed interior surfaces shall not be capable of producing excessive quantities of smoke and toxic products, this being determined in accordance with the *FTP Code*, Annex 1, Part 2.

**6.20.13.8** Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of an approved material which will not readily ignite or give rise to toxic or explosive hazards at elevated temperatures, this being determined in accordance with the *FTP Code*, Annex 1, Part 6.

#### **6.20.14 Fixed Fire Detection, Fire Alarm and Automatic Sprinkler System in Ship Spaces**

**6.20.14.1** In ships carrying not more than 36 passengers and in ships with a length of less than 24 metres there shall be installed throughout each separate zone, whether vertical or horizontal, in all accommodation and service spaces and in control stations, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc., either:

- .1** type-approved fixed fire detection and fire alarm system in accordance with the requirements specified in 4.1 and 6.1.14 which shall be so installed and arranged as to detect the presence of fire in such spaces, and also providing smoke detection in corridors, stairways and escape routes within accommodation spaces; or
- .2** type-approved automatic sprinkler system, in accordance with the requirements specified in 3.3 and 6.1.13, which shall be so installed and arranged as to protect such spaces and, additionally, a type-approved fixed fire detection and fire alarm system in accordance with the requirements specified in 4.1 and 6.1.14 which shall be so installed and arranged as to

provide smoke detection in corridors, stairways and escape routes within accommodation spaces.

**6.20.14.2** Ships carrying more than 36 passengers shall be fitted with:

- .1** type-approved automatic sprinkler system in accordance with the requirements specified in 3.3 and 6.1.13 installed in all service spaces, control stations and accommodation spaces, including corridors and stairways. Alternatively control stations where water may cause damage to essential equipment may be fitted with an approved fixed fire-extinguishing system of another type; and
- .2** type-approved fixed fire detection and fire alarm system in accordance with the requirements specified in sub-chapters 4.1 and 6.1.14 which shall be so installed and arranged as to provide smoke detection in service spaces, control stations and accommodation spaces, including corridors and stairways. Smoke detectors need not be fitted in private bathrooms and galleys.

Spaces having little or no fire risk such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with an automatic sprinkler system or fixed fire detection and alarm system.

**6.20.14.3** Ships with a length of less than 24 metres shall be fitted with an automatic sprinkler system and fixed fire detection and alarm system as required for ships carrying more than 36 passengers in 6.20.14.1.

**6.20.14.4** In ships assigned an additional mark indicating their adjustment to periodically unattended operation of the machinery spaces, a type-approved fixed fire detection and alarm system shall be installed in the machinery spaces in accordance with the requirements specified in sub-chapter 6.16.2.

Where the navigating bridge is unattended, the alarm system shall be operable from the position attended by an authorised crew member.

**6.20.15 Fire Protection of Special Category Spaces**

The requirements specified in 6.10.2 shall be fulfilled.

**6.20.16 Additional Requirements for Ships Carrying Dangerous Goods**

Passenger ships carrying dangerous goods shall comply with the requirements specified in sub-chapter 2.10.

**6.20.17 Requirements for Ships Cooperating with Helicopter**

Ships cooperating with helicopter shall comply with the requirements specified in 7.1.

## **6.21 Cargo Ships of Less than 500 Gross Tonnage – Minimum Requirements**

The requirements specified in sub-chapter 6.21 apply to cargo ships including tugs, supply vessels, dredgers, hopper barges, pilot craft, as well as barges and pontoons without their own propulsion (except for chemical carriers and gas tankers) of less than 500 gross tonnage.

These ships shall fulfil the applicable requirements specified in 2.1 to 2.8; the requirements specified in present sub-chapter shall be complied with in each particular case.

Chemical carriers and gas tankers shall fulfil requirements of the *IBC Code* and the *IGC Code*, respectively – see sub-chapters 6.12 and 6.11.

### **6.21.1 Structural Fire Protection**

#### **6.21.1.1 Structural Fire Protection of Divisions Separating Adjacent Spaces**

Machinery spaces of category A shall be enclosed by A-60 Class divisions where adjacent to: accommodation spaces, control stations, corridors, staircases and by A-0 Class divisions elsewhere.

Galleys shall be separated from the adjacent spaces by at least A-0 Class divisions.

Service spaces of high fire risk other than galley shall be separated from the adjacent spaces by at least B-15 Class divisions.

Corridors and staircases shall be separated from the adjacent spaces by at least B-0 Class divisions.

Cargo spaces shall be separated from the adjacent spaces by at least A-0 Class divisions.

Divisions used to separate spaces other than those, referred to above, shall be of non-combustible material.

#### **6.21.1.2 Closing Arrangements for Openings in Fire Divisions**

Openings in A Class divisions shall be provided with permanently attached means of closing which shall be at least as effective for resisting fires as the divisions in which they are fitted.

Doors shall be self-closing in way machinery spaces of category A and galleys, except where they are normally kept closed.

#### **6.21.1.3 Means of Control in Machinery Spaces of Category A**

In category A machinery spaces, means of control specified in 2.1.4.3 shall be used. These controls, as well as the controls of fire-extinguishing systems shall be situated at one control position outside the space concerned where they will not be cut off in the event of fire in the space they serve. Such positions shall have safe access from the open deck.

#### 6.21.1.4 Means of Escape

There shall be at least two means, as widely separated as possible, of escape to the open deck from each section of accommodation and service spaces and control stations.

The normal means of escape to the accommodation and service spaces below the open deck shall be so arranged that it is possible to reach the open deck without passing through spaces containing a possible source of fire (e.g. machinery spaces, storage spaces of flammable liquids). The second means of escape may be through portholes or hatches of adequate size leading directly to the open deck.

At least two means of escape shall be provided from machinery spaces of category A by steel ladders one of which shall not be an emergency exit.

#### 6.21.2 Water Fire Main System

##### 6.21.2.1 Fire Pumps

Water fire main system shall be supplied by one main fire pump, independently driven; one portable fire pump shall be additionally provided on board the ship.

The total capacity of the main fire pump shall be determined in accordance with the following formula:

$$Q = (0.145(L(B+D))^{1/2} + 2.17)^2, [\text{m}^3/\text{h}],$$

need not, however, exceed 25 m<sup>3</sup>/h

where:

*L* – length of ship, [m] – see *Part I – Classification Regulations*;

*B* – moulded breadth, [m] – see *Part I – Classification Regulations*;

*D* – moulded depth to bulkhead deck, [m].

On ships of gross tonnage 150 and upwards, the pressure maintained at any hydrant shall be sufficient to produce a jet throw at any nozzle of not less than 12 m.

On ships of gross tonnage less than 150, a lesser jet of water may be specially considered.

##### 6.21.2.2 Portable Fire Pump

6.21.2.2.1 Portable fire pump shall fulfil the following requirements:

- .1 the pump shall be self-priming and have a capacity at least 12 m<sup>3</sup>/h;
- .2 the total suction head and the net positive suction head of the pump shall be determined taking account of actual operation, i.e. pump location when used and the size of the ship;
- .3 the portable fire pump, when fitted with its length of discharge hose and nozzle, shall be capable of maintaining a pressure sufficient to produce a jet throw of at least 12 m, or that required to enable a jet of water to be directed on any part of the engine room or the exterior boundary of the engine room and casing, whichever is greater;



- .4 except for electric pumps, the pump set shall have its own fuel tank of sufficient capacity to operate the pump for three hours. For electric pumps, their batteries shall have sufficient capacity for three hours;
- .5 the pump powered by an internal combustion engine shall use oil fuel having a flash point above 60 °C. If the fuel type has a flashpoint below 60 °C, further consideration to the fire safety aspects shall be given;
- .6 the pump set shall be stored in a secure, safe and enclosed space, accessible from the open deck and clear of the machinery space of category A;
- .7 the pump set shall be easily moved and operated by two persons and readily available for immediate use;
- .8 arrangements shall be provided to secure the pump at its anticipated operating position(s);
- .9 the overboard suction hose shall be non-collapsible and of sufficient length to ensure suction under all operating conditions. A suitable strainer shall be fitted at the inlet end of the hose;
- .10 any diesel-driven source for the pump shall be capable of being readily started in its cold condition by hand (manual cranking);

Means to illuminate the stowage area of the portable pump and its necessary areas of operation shall be provided from the emergency source of electrical power.

On ships of gross tonnage less than 150, a portable fire pump need not be provided if an approved fixed total flooding fire-extinguishing pump is fitted in the machinery space.

**6.21.2.2.2** In lieu of portable fire pump, a fixed fire pump may be used which should comply with the following:

- .1 the pump, its source of power and sea connection shall be located in accessible positions, outside the compartment housing the main pump;
- .2 the valve shall be capable of being operated from a position near the pump;
- .3 the room where the fire pump and its prime mover is located shall be illuminated from the emergency source of electrical power and shall be ventilated;
- .4 where the pump is required to supply water for a fixed fire-extinguishing system in the space where the main fire pump is situated, it shall be capable of simultaneously supplying water to this system and the fire main at the required rates;
- .5 the pump may also be used for other suitable purposes, subject to PRS' consent in each particular case;
- .6 pressure and quantity of water delivered by the pump shall be sufficient to produce a jet of water, at any nozzle, of not less than 12 m in length. On ships of gross tonnage less than 150, a lesser jet of water may be specially considered.

### **6.21.2.3 Piping**

The diameter of the fire main shall be based on the required capacity of the fixed main fire pump(s) and the diameter of the water service pipes shall be sufficient to ensure an adequate supply of water for the operation of at least one fire hose.

If a fixed fire pump, instead of a portable pump, is fitted outside the engine room where the main fire pump is situated, an isolating valve shall be fitted in the fire main so that all the hydrants on board the ship, except those in the machinery space, can be supplied with water. The isolating valve shall be located in an easily accessible and tenable position outside the machinery space.

The fire main shall not re-enter the machinery space downstream of the isolating valve.

### **6.21.2.4 Fire Hydrants**

On ships of 150 gross tonnage and upwards, the number and position of hydrants shall be such that at least two jets of water may reach any accessible part of the ship in accordance with the requirements specified in 3.2.6.2.

On ships of less than 150 gross tonnage, the number and position of hydrants shall be such that at least one jet of water may reach any accessible part of the ship. At least one hydrant shall be provided in each machinery space of category A.

### **6.21.2.5 Fire Hoses**

Fire hoses shall, in general, have a length not exceeding 18 m.

Ships of 150 gross tonnage and upwards shall be provided with fire hoses the number of which shall be one for each 30 m length of the ship and additionally a spare one, in no case, however, less than three in all.

On ships of less than 150 gross tonnage, one hose shall be provided for each hydrant. In addition one spare hose shall be provided onboard.

### **6.21.3 Fixed Fire Detection and Fire Alarm Systems in Machinery Spaces of Category A**

In each machinery space of category A, a fixed fire-detection and fire-alarm system shall be installed in accordance with the requirements specified in 6.16.2.

### **6.21.4 Fixed Fire-Extinguishing System in Machinery Spaces of Category A**

On ships of 150 gross tonnage and upwards, machinery spaces of category A shall be provided with a type-approved fixed total flooding fire-extinguishing system complying with the applicable requirements specified in 2.5.1.1.

### **6.21.5 Fire Protection of Paint Lockers and Flammable Liquid Lockers**

Paint lockers and flammable liquid lockers shall be provided with at least one portable 6 kg dry powder fire extinguishers situated directly at the entrance to such a locker.

## **6.21.6 Fire-Fighting Equipment**

### **6.21.6.1 Portable Fire-Extinguishers**

The minimum number of portable fire-extinguishers shall be as follows:

- .1** in accommodation spaces, service spaces and control stations:
  - on ships of 150 gross tonnage and upwards – at least 3 extinguishers;
  - on ships of less than 150 gross tonnage – at least 1 extinguisher;
- .2** in machinery spaces (one extinguisher per every 375 kW of internal combustion engine power) – at least 2 extinguishers, however, not more than 6 extinguishers are required.

Accommodation spaces, service spaces and control stations shall be provided with a sufficient number of portable fire-extinguishers which shall be so arranged as to ensure that at least one extinguisher will be readily available for use in every compartment of these spaces and to ensure that at least one extinguisher will be available at each deck having accommodation or service spaces, or control stations.

For each required portable fire-extinguisher, duplicate extinguishers shall be provided.

### **6.21.6.2 Fire-Fighter's Outfit**

All cargo ships of 150 gross tonnage and upwards shall be provided with at least one fire-fighter's outfit (including an axe) in accordance with the requirements specified in 5.1.4.

### **6.21.6.3 Fire Blanket**

Each ship shall be provided with at least one fire blanket.

## **6.21.7 Fire Protection of Tankers Carrying Products with a Flash-point Not Exceeding 60 °C**

These tankers shall fulfil the requirements specified in sub-chapter 6.3.

## **6.21.8 Additional Fire Protection of Tankers Carrying Products with a Flash-point Exceeding 60 °C**

### **6.21.8.1 Cargo Pump-Room**

In the cargo pump-room, a type-approved fixed fire-detection and alarm system shall be installed, complying with the applicable requirements specified in 4.1.

### **6.21.8.2 Cargo Area Deck Protection**

On the cargo tank deck, the following fire-fighting equipment shall be provided:

- mobile foam-type fire-extinguishing unit having 135 l; or
- portable foam applicator unit in accordance with the requirements specified in 5.1.3.

Foam concentrate used shall be suitable for the cargoes to be carried.

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### **6.21.9 Fire Protection of Ships not Fitted with Propelling Machinery**

The requirements for fire protection for such ships are specified by PRS considering in each case their size and purpose, arrangement of the accommodation spaces, machinery and combustible materials on board.

The scope of documentation for consideration and approval to be submitted to PRS Head Office shall be agreed with PRS in each particular case; such documentation shall indicate the proposed fire protection structural arrangements, applications of fixed fire-detection and alarm systems, as well as fire-extinguishing systems and also state the positioning of portable fire-extinguishers.

#### **6.21.10 Fire Control Plan**

On all cargo ships, *Fire Control Plan* complying with the requirements specified in 1.4.2, shall be exhibited on board the ship.

On ships of 150 gross tonnage and upwards, a duplicate of *Fire Control Plan* shall be kept in a firmly sealed container positioned outside the superstructure at the entrance to be used by the shore fire brigade during the fire while in port.

### **6.22 Ships with Natural Gas-Fuelled Engines**

Fire protection of those ships shall be in accordance with the guidelines specified in *Publication No. 88/P* (Res. MSC.285(86)).

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## **7 REQUIREMENTS FOR APPLIANCES AND EQUIPMENT POSING ADDITIONAL RISK OF FIRE**

### **7.1 Helicopter Facilities**

#### **7.1.1 Application**

**7.1.1.1** Depending on helicopter operation, ships shall be provided with specially designated and equipped areas: helideck, helicopter landing area or winching area, defined in 7.1.2.

**7.1.1.2** Ships equipped with helideck shall comply with the requirements specified in sub-chapter 7.1.3, 7.1.4, 7.1.6 and 7.1.8.

**7.1.1.3** Ro-ro passenger ships of 130 m in length or above provided with helicopter landing area, constructed in accordance with the recommendations given in MSC/Circ.895, shall comply with the requirements specified in sub-chapters 7.1.5 and 7.1.8.

**7.1.1.4** Ships provided with a winching area shall be fitted with portable fire-fighting equipment, as specified in particular chapters of the present *Part* for the given type of ship, located in the vicinity of the winching area.

**7.1.1.5** Ships provided with helicopter refueling and hangar facilities shall comply with the requirements specified in sub-chapter 7.1.6.

#### **7.1.2 Definitions**

For the purpose of the present Chapter, the following definitions have been adopted:

- .1 Helideck** – a purpose-built helicopter landing platform or other deck area including all structure, fire-fighting appliances and other equipment necessary for the safe operation of helicopter.
- .2 Helicopter landing area** – an area on a ship designated for occasional or emergency landing of helicopter and not designed for routine helicopter operations.
- .3 Winching area** – a pick-up area provided for the transfer by helicopter of personnel or stores to or from the ship, while helicopter hovers above the deck.

#### **7.1.3 Helideck Structure**

**7.1.3.1** Helideck shall be constructed of steel or other equivalent material. If the helideck forms the deckhead of a deckhouse or superstructure, it shall be insulated to A-60 Class standard.

**7.1.3.2** Aluminium or other low-melting metal construction is permitted, provided the following requirements are fulfilled:

- .1** if the platform is cantilevered over the side of the ship, then after each fire on the ship or on the platform, the platform shall undergo a structural analysis to determine its suitability for further use;
- .2** if the platform is located above the ship's deckhouse or a similar structure, the following requirements shall be fulfilled:
  - .1** the deckhouse top and bulkheads under the platform shall have no openings;
  - .2** all windows under the platform shall be provided with steel covers;
  - .3** after each fire on the platform or in close proximity, the platform shall undergo a structural analysis to determine its suitability for further use.

**7.1.3.3** Helideck shall be provided with both the main and an emergency means of escape and access for fire-fighting and rescue personnel. These means of escape shall be located as far apart from each other as practicable and preferably on the opposite sides of the helideck.

**7.1.3.4** Helideck shall be provided with drainage facilities, constructed of steel and led directly overboard, independent of any other system and so designed that drainage does not fall on to any part of the ship.

#### **7.1.4 Fire-Fighting and Helideck Fire Protection**

**7.1.4.1** Helideck shall be fitted with a fixed foam system complying with the requirements specified in 7.1.6.

**7.1.4.2** The helideck area shall be provided with a least 2 fire hydrants and 2 dual-type nozzles, with a fire hose capable of supplying water to each part of the helideck.

**7.1.4.3** In the close proximity of the helideck, the following fire-fighting appliances shall be provided:

- .1** at least two mobile dry-powder extinguishers having a total capacity of not less than 45 kg;
- .2** carbon dioxide fire-extinguishers of a total capacity not less than 18 kg or equivalent;
- .3** two sets of fire-fighter's outfits in accordance with the requirements specified in 5.1.4, in addition to those required elsewhere in *Part V*;
- .4** at least one rescue kit, stored in a manner that provides for immediate use and protection against weather conditions, consisting of:
  - adjustable wrench;
  - blanket, fire-resistant;
  - cutters, bolt 60 cm;
  - hook;

- hacksaw, heavy duty, complete with 6 spare blades;
- ladder;
- lifeline of 5 mm in diameter and 15 m in length;
- pliers, side-cutting;
- set of assorted screwdrivers;
- harness knife complete with sheath.

### 7.1.5 Fire Protection of Helicopter Landing Area

**7.1.5.1** For helicopter landing areas, at least two hose reel foam stations shall be provided, each capable of discharging a minimum foam solution discharge rate, depending on helicopter category in accordance with Table 7.1.6.3 or alternatively at least two portable foam applicators.

**7.1.5.2** The helicopter landing area shall be provided with a least 2 fire hydrants and 2 duel-type nozzles, with a fire hose capable of supplying water to each part of the landing area.

**7.1.5.3** The quantity of foam concentrate shall be adequate to allow operation of all connected discharge devices for at least 10 min.

**7.1.5.4** Hose reel foam station and fire hydrants shall be provided with a means of access that does not require travel across the helicopter landing area.

**7.1.5.5** In addition, the fire-fighting equipment, listed in 7.1.4.3, shall be provided in the vicinity of the helicopter landing area.

### 7.1.6 Foam Fire-Extinguishing System for the Helideck

**7.1.6.1** For helideck, the foam system shall contain at least two fixed foam monitors or deck integrated foam nozzles.

**7.1.6.2** In addition, at least two hose reels fitted with foam-making branch pipe and non-collapsible hose sufficient to reach any part of the helideck shall be provided.

**7.1.6.3** Depending on helicopter category, the minimum foam system discharge rate shall be determined by multiplying the D-value area, given in Table 7.1.6.3, by  $6 \text{ l/min/m}^2$ .

**Table 7.1.6.3**

Helicopter category	Helicopter overall length $L$	Discharge rate of foam solution [l/min]
H1	$L < 15 \text{ m}$	250
H2	$15 \text{ m} \leq L < 24 \text{ m}$	500
H3	$24 \text{ m} \leq L < 35 \text{ m}$	800

**7.1.6.4** The minimum foam system discharge rate for deck integrated foam nozzle system shall be determined by multiplying the overall helideck area by 6 l/min/m<sup>2</sup>.

**7.1.6.5** The foam concentrate shall be approved type and be demonstrated effective for extinguishing aviation fuel spill fires and shall conform to performance standards not inferior to those specified in MSC.1/Circ.1312/Corr.1. Where the foam storage tank is on the exposed deck, freeze protected foam concentrates shall be used, if appropriate, for the area of operation.

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

**7.1.6.7** Means shall be provided for the crew to safely check the quantity of foam concentrate in the tanks and taking the foam concentrate samples for the periodical checking of its quality. The minimum level/required quantity of foam concentrate shall be marked on the tank.

The location of the foam concentrate storage tank shall be indicated by a plate with the symbol used *on Fire Control Plan*.

**7.1.6.8** Each monitor shall be capable of supplying at least 50% of the minimum foam system discharge rate, but not less than 500 l/min. The minimum discharge rate of each hose reel shall be at least 400 l/min.

**7.1.6.9** The foam system shall be capable of manual release, and may be arranged for automatic release.

**7.1.6.10** The distance from the monitor to the farthest extremity of the protected area shall be not more than 75% of the monitor throw in still air conditions.

**7.1.6.11** Manual release station capable of starting necessary pumps and opening required valves, including the fire main system, if used for water supply, shall be located at each monitor and hose reel. In addition, a central manual release station shall be provided at a protected location. The foam system shall be designed to discharge foam with nominal flow and at design pressure from any connected discharge devices within 30 s of activation.

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

**7.1.6.13** The system and its components shall be designed to withstand ambient temperature changes, vibration, humidity, shock impact and corrosion normally encountered on the open deck.

**7.1.6.14** A minimum nozzle throw of at least 15 m shall be provided with all hose reels and monitors discharging foam simultaneously. The discharge pressure,



flow rate and discharge pattern of deck integrated foam nozzles shall be so selected as to ensure capability to extinguish fires involving the largest size helicopter for which the helideck is designed.

**7.1.6.15** Monitors, foam making branch pipes, deck integrated foam nozzles and couplings shall be constructed of brass, bronze or stainless steel. Pipings, fittings and related components, except gaskets, shall be designed to withstand 925 °C.

**7.1.6.16** All manual release stations, foam monitors and hose reels shall be provided with a means of access that does not require travel across the helicopter landing area.

**7.1.6.17** Oscillating monitors, if used, shall be preset to discharge foam in spray pattern and have a means of disengaging the oscillating mechanism to allow rapid conversion to manual operation.

**7.1.6.18** If foam monitors with flow rate up to 1000 l/min are installed, they shall be equipped with air-aspirating nozzles. If a deck integrated nozzle system is installed, then the additionally installed hose reel shall be equipped with an air-aspirating handline nozzle. The use of non air-aspirating foam nozzles (on both: monitors and the additional hose reel) is permitted only where foam monitors with a flow rate above 1000 l/min are installed.

### **7.1.7 Helicopter Refuelling and Hangar Facilities**

**7.1.7.1** If the ship is provided with helicopter refueling and hangar facilities, the requirements specified in this sub-chapter shall be fulfilled.

**7.1.7.2** Hangar shall be treated as machinery space of category A with regard to structural fire protection.

**7.1.7.3** Hangar shall be fitted with a fixed total flooding fire-extinguishing system, required in 2.5.1.1 for machinery spaces of category A and fire detection and fire alarm system.

The loop of fire detectors in hangar shall not include detectors and manually operated call points installed in machinery space category A.

**7.1.7.4** Designated area shall be provided for the storage of fuel tanks which shall be:

- .1** as remote as is practicable from accommodation spaces, escape routes and lifeboat embarkation stations; and
- .2** isolated from areas containing a source of vapours ignition.

**7.1.7.5** Fuel storage area shall be provided with arrangements whereby fuel spillage may be collected and drained to a safe location.

**7.1.7.6** Fuel storage tanks shall be constructed of metal, be fitted with fuel level indicator, fuel filling and refueling pipe connector with a filter, fuel contamination drain cover, fuel samples cock and ventilating pipes fitted with vent heads of an approved type with flame arresters. Areas where fuel tanks are situated and fuelling operations conducted are to be suitably isolated from enclosed spaces or other areas which contain a source of vapour ignition.

**7.1.7.7** Portable fuel storage tanks shall be of appropriate design and be suitably installed, protected against damage and earthed.

**7.1.7.8** Storage tank fuel pumps shall be provided with means which permit shutdown from a safe remote location in the event of a fire. Where a gravity fuelling system is installed, equivalent closing arrangements shall be provided to isolate the fuel source.

**7.1.7.9** Fuel pumping unit shall be connected to one tank at a time. The piping between the tank and the pumping unit shall be of steel or equivalent material, as short as possible, and protected against damage.

**7.1.7.10** Electrical fuel pumping units and associated control equipment shall be of an explosion-proof type.

**7.1.7.11** Fuel pumping units shall incorporate a device which will prevent over-pressurization of the delivery or filling hose.

**7.1.7.12** Equipment used in refueling operations shall be electrically bonded.

**7.1.7.13** "NO SMOKING" signs shall be displaced in vicinity of helicopter refueling and on access door to hangar.

**7.1.7.14** Enclosed hangar facilities or enclosed spaces containing refuelling installations shall be provided with mechanical ventilation in accordance with the requirements specified in sub-chapter 11.9, *Part VI – Machinery Installations and Refrigerating Plants*.

**7.1.7.15** Electric equipment and wiring in enclosed hangar or enclosed spaces containing refueling installations shall be of an explosion-proof type.

## **7.1.8 Helicopter Operation Manuals**

**7.1.8.1** For each helideck, *Operation Manual* containing a description and a checklist of safety precautions, procedures and equipment requirements shall be prepared. Such a manual may be part of the ship's emergency response procedures.

**7.1.8.2** *Operation Manual* shall contain safety procedures and precautions to be followed during helicopter refueling operations.

**7.1.8.3** *Operation Manual* shall include the responsibilities of fire-fighting personnel consisting of at least two persons who shall be present on the helideck at all times when helicopter operations and refuelling are expected.

## **7.2 Store-Rooms for Flammable Liquids with a Flash-Point below 43 °C**

**7.2.1** Flammable liquids with a flash-point below 43 °C, determined by an approved flash-point apparatus (closed cup test) shall be stored inside ventilated store-rooms in metallic receivers; each of such receivers shall be fitted with:

- .1 self-closing tap valve;
- .2 fuel level indicator closed type;
- .3 pipe for filling the receiver from outside of the store-room;
- .4 vent pipes led out to the open deck, fitted with vent heads of an approved type with flame arresters;
- .5 drip tray.

The quantities of any flammable liquids not exceeding 35 *l* may be stored in metallic canisters with tight closure.

Where the total volume of the receivers exceeds 250 *l* (but does not exceed 2500 *l*), the store-room used for their storage shall be fitted with independent mechanical ventilation ensuring the removal of air from the lower parts of the space at the rate not less than 20 changes per hour.

Supply ventilation may be of natural type.

Switching on the fans shall be combined with the arrangement opening the access door to the store-room. The whole equipment inside the store-room space shall be of explosion-proof type in accordance with the requirements specified in sub-chapter 2.8, *Part VIII – Electrical Installations and Control Systems*.

Where the quantity of flammable liquids exceeds 2500 *l*, the tanks for their storage shall fulfil the requirements specified in 7.3.

**7.2.2** In ships of less than 300 gross tonnage, where the arrangement of a special space for flammable liquids of a flash-point below 43 °C is not practicable, the liquids can be stored in steel ventilated cabinets or boxes. Such cabinets or boxes shall not be adjacent to accommodation spaces and their doors shall open outside.

Inside the cabinets or boxes, the liquids shall be stored in metallic canisters with tight closures and their total volume shall not exceed 50 *l*.

## **7.3 Tanks and Distributing Stations Intended for Fuel of a Flash-Point below 43 °C**

**7.3.1** Tanks intended for fuel of a flash-point below 43 °C, determined by an approved apparatus (close-cup test), shall fulfill the following requirements:

- .1 they shall be built into the ship's hull near its fore or aft portion, if possible;
- .2 they shall be surrounded from all sides and corners, excluding the side below the lowest waterline, with cofferdams which, in normal service

conditions, shall be filled with inert gas. Air pipes shall fulfil the requirements specified in sub-chapter 9.1, *Part VI – Machinery Installations and Refrigerating Plants*. The cofferdams shall be fitted with sounding pipes led out to the open deck;

- .3 each fuel tank shall be fitted with the piping as follows: filling pipes, fuel discharge pipes, sounding and air pipes. The lower end of filling pipe shall be situated not more than 300 mm and the lower end of sounding pipe not more than 30 mm above the tank bottom. It is recommended that closed type level meter, instead of the sounding pipes, be used;
- .4 vent pipes of the tank shall be raised at least 2.5 m above the open deck. The outlets of these pipes shall be at the distance of at least 9 m from openings in superstructures and deckhouses and shall be fitted with approved type flame arresters;
- .5 all fuel tank pipes shall be led from the tanks to oil fuel stations inside a separate gastight trunk of dimensions enabling access over the whole length of the trunk. The trunk walls shall be made as A-60 Class divisions or, if the trunk shall be filled with water or inert gas, A-0 Class division. In all cases, the supply and exhaust ventilation of the trunk shall be ensured. The outlets of ventilation pipes shall be fitted with flame arresters;
- .6 all the fuel pipelines, machinery, fittings and instruments associated with fuel storage and transport shall be reliably grounded to the ship's hull structure in order to avoid formation of electrostatic charges.

**7.3.2** Distributing stations for fuel with a flash-point below 43 °C shall fulfil the following requirements:

- .1 they shall be located on the open deck as far as possible from accommodation spaces and from possible sources of ignition;
- .2 they shall be enclosed with A-60 Class fire-resisting divisions. The doors may be A Class doors, made of steel without insulation. The station shall be bounded with gastight bulkheads and decks;
- .3 deck linings, door closing appliances and the station equipment shall preclude the possibility of sparking;
- .4 the station shall be fitted with drip trays for collecting and draining the spilled oil to suitable drain tank.

## **7.4 Cylinders Containing Welding Gases (Oxygen or Acetylene)**

### **7.4.1 General Requirements**

**7.4.1.1** The cylinders containing welding gases shall be supplied with PRS Certificate.

**7.4.1.2** The cylinders shall be fitted with cylinder valve caps.

**7.4.1.3** The storage of cylinders containing oxygen or acetylene in machinery spaces is prohibited.

## **7.4.2 Compartments for the Storage of Cylinders**

**7.4.2.1** Cylinders containing welding gases (oxygen, acetylene, etc.) shall be stored in a dedicated compartment designed for that purpose, complying with the following requirements:

- .1** direct access to such a compartment from the open deck shall be provided and the door shall be locked;
- .2** the compartment shall be bounded by A-0 Class partition and shall be separated from the fire-hazardous adjacent spaces by A-60 Class fire divisions;
- .3** except as necessary for service within the space, electrical wiring and fittings are not permitted within the compartment. Where such electrical fittings are installed, they shall be of an explosion-proof type;
- .4** separate compartment shall be provided for each type of compressed gas;
- .5** the compartment used for the storage of such gases shall not be used for other purposes;
- .6** the compartment shall be provided with effective ventilation system;
- .7** “NO SMOKING” and “EXPLOSION HAZARD. NO NAKED LIGHT” notices shall be displayed on the entrance to such compartment;
- .8** the compartment shall be provided with safety manual containing the following information:
  - on completion of work, all cylinder valves shall be kept in close position;
  - flammable materials (especially oil or fat) shall not be kept in the vicinity of cylinders containing oxygen;
  - cylinder valves shall not be handled with oily or greasy hands.

**7.4.2.2** Cylinders containing technical gases, including empty cylinders shall be stored in an upright position and properly secured so as to ensure their quick removal. The cylinders shall have a clearly legible identification of the name and chemical formula of their contents.

**7.4.2.3** Cylinders shall be stored on a base made from wood or other material in such a way as not be in direct contact with deck surface.

## **7.4.3 Storage of the Cylinders on Open Deck**

Cylinders containing welding gases – not more than two such cylinders – may be stored on open decks in designated positions which shall fulfil the following requirements:

- .1** such positions shall be at a distance of at least 10 m from accommodation and control stations and at least 4 m from the compartments where flammable materials are stored;

- .2 such positions shall be protected against excessive variations in temperature and weather conditions, as well as against mechanical damage;
- .3 “NO SMOKING” and “EXPLOSION HAZARD. NO NAKED LIGHT” notices shall be displayed in the vicinity of the cylinders.

#### **7.4.4 Welding Gases Installation**

**7.4.4.1** The pipes supplying oxygen and acetylene to a welding shop shall be made of steel, be connected by welded pipe coupling or flanges.

**7.4.4.2** Each pipeline shall be fitted with pressure reducing valve and cut-off valve.

**7.4.4.3** Where two or more cylinders are connected to a manifold, the supply pipe, between cylinders, shall be fitted with non-return valves.

**7.4.4.4** The cylinders shall be connected to the manifold by elastic pipes of approved type.

**7.4.4.5** The manifold shall be fitted with a safety valve. The outlet from the safety valve shall be led to the open deck, in a place which will not pose fire hazard.

**7.4.4.6** After installation on board, the system is subject to acceptance and tests in accordance with the approved documentation. The pipes are subject to strength tightness tests, with a test pressure equal at least 1.25 of oxygen and acetylene working pressure.

#### **7.5 Heating of Spaces**

**7.5.1** Electric heating of spaces shall fulfil the requirements specified in Chapter 15, *Part VIII – Electrical Installations and Control Systems*.

**7.5.2** All heaters shall be so constructed and positioned as to preclude the possibility of ignition of window curtains or space furnishings, as well as the luggage and clothing left by the persons using the space concerned.

**7.5.3** Usage of heating appliances with open fire, such as solid fuel (coal) or gas burning boilers with open burners is not permitted.

#### **7.6 Gas Fuel System for Domestic Purposes**

**7.6.1** Gas fuel system for domestic purposes shall fulfil the relevant national standards of the Flag State. After its installation on board, the system is subject to acceptance and tests in accordance with the approved documentation.

**7.6.2** Cylinders containing liquefied gas for domestic purposes shall be stored on the open deck or in a well ventilated space which opens only to the open deck.

**7.6.3** A portion of open deck, recessed into a deck structure, machinery casing, deck house, etc., utilised for the exclusive storage of gas bottles is considered acceptable, provided that:

- .1** such a recess has 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 greater 1 m.

The recesses, specified above, shall be considered as open deck to determine the fire integrity of boundaries of the adjacent spaces.

**7.6.4** The system shall comply with the applicable requirements specified in the *Rules for the Classification and Construction of Inland Waterways Vessels, Part V – Fire Protection*, 2010, sub-chapter 7.3.

## **7.7 The Arrangement of Oil Fuel Tanks**

Oil fuel tanks, which do not form an integral part of the ship's structure, shall be arranged and separated from other tanks/spaces in accordance with the requirements specified in sub-chapter 12.7, *Part VI – Machinery Installations and Refrigerating Plants*.

## SUPPLEMENT – RETROACTIVE REQUIREMENTS

### 1 GENERAL

**1.1** The requirements specified in the present *Supplement* apply to existing ships, irrespective of their construction date, unless provided otherwise elsewhere in this *Supplement*.

**1.2** Compliance with the applicable retroactive requirements is confirmed by PRS' Surveyor in the report on the nearest ship survey, to be carried out after the requirements compliance date.

### 2 REQUIREMENTS

#### 2.1 Halon Fire-Extinguishing Systems

**2.1.1** In accordance with *Regulation (EC) No. 1005/2009 of the European Parliament and of the Council, of 16 September 2009 on substances that deplete the ozone layer*, on existing ships flying the flag of the European Union Member State, halon fire-extinguishing systems containing such halons as: 1211, 1301 and 2402, considered as controlled substances listed in Annex I (group III) to this *Regulation*, are prohibited. Also portable fire-extinguishers containing the above-mentioned halons are prohibited on board.

**2.1.2** If an existing ship, to which PRS class is to be assigned, carries a halon system, such a system, until the issue of Certificate of Class, shall be dismantled and halon shall be recovered in order to be destroyed, recycled or reclaimed by a service station approved by the Flag State Administration for conformity with the environmental protection rules. The dismantled halon system shall be replaced by carbon dioxide fire-extinguishing system, complying with the requirements specified in sub-chapter 3.6.4, *Part V* of the *Rules* or an equivalent gas fire-extinguishing system, complying with the requirements specified in sub-chapter 3.7, *Part V* of the *Rules*.

**2.1.3** Portable fire-extinguishers containing the above-mentioned halons shall be replaced by other approved fire-extinguishers, complying with sub-chapter 5.1, *Part V* of the *Rules*.

**2.1.4** Documentation of a new equivalent fire-extinguishing system is subject to approval by the PRS Head Office. After installation on board, the system shall be accepted and tested under PRS Surveyor's supervision for compliance with the approved documentation.



## **2.2 Requirements for Cargo Ships of Gross Tonnage Less than 500, Constructed before 1 July 2008**

Cargo ships of gross tonnage 150 and upwards of unrestricted service, to which PRS class is to be assigned, until the issue of Certificate of Class, shall comply with the following requirements:

- a portable fire pump shall be provided on board in accordance with the requirements specified in 6.21.2.2, *Part V*, if the fire main system is supplied by only one main fire pump;
- in machinery spaces of category A, a fire detection and fire alarm system in accordance with the relevant requirements specified in 6.16.2, *Part V* shall be installed unless the machinery space is fitted with a fixed gas fire-extinguishing system;
- for each required portable fire-extinguisher, duplicate extinguishers shall be provided;
- *Fire Control Plan* shall be exhibited on board the ship in accordance with the requirements specified in 1.4.2, *Part V*.

## **2.3 Requirements for Carbon Dioxide Systems Used in Ships Constructed before 1 July 2002**

By the first scheduled dry-docking after 1 January 2010, but not later than 1 January 2013, fixed carbon dioxide fire-extinguishing systems for the protection of machinery spaces and cargo pump-rooms shall be provided with two independent controls of the carbon dioxide discharge to the protected space, located inside the release cabinet in accordance with the requirements specified in 3.6.4.2.2.

## **2.4 Portable Instruments for Measuring Oxygen and Flammable Vapour Concentrations on Tankers – Mark: CRUDE OIL TANKER, PRODUCT CARRIER A**

Each tanker constructed before 1 July 2002, by the first class confirmation/renewal survey, but not later than 1 January 2013, shall be equipped with at least two instruments for measuring oxygen and at least two instruments for measuring flammable vapour concentrations, together with a sufficient set of spares. Suitable means shall be provided for the calibration of such instruments. As an alternative, at least two dual-purpose type instruments capable of measuring both oxygen and flammable vapours, with a set of spare parts, may be used

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**List of IMO documents referred to in Part V of the Rules**

**IMO Assembly Resolutions**

1. A.567(14): Regulation for Inert Gas Systems on Chemical Tankers.
2. A.654(16): Graphical Symbols for Fire Control Plans.
3. A.752(18): Guidelines for the Evaluation, Testing and Application of Low-Location Lighting on Passenger Ships.
4. A.753(18): Guidelines for the Application of Plastic Pipes on Ships.
5. A.756(18): Guidelines on the Information to be Provided with Fire Control Plans and Booklets Required by SOLAS Regulations II-2/20 and 41-2.
6. A.951(23): Improved Guidelines for Marine Portable Fire Extinguishers.
7. A.952(23): Graphical Symbols for Shipboard Fire Control Plans.
8. A.1021(26): Code on Alerts and Indicators.

**MSC/MEPC Resolutions**

1. MSC.285(86): Interim Guidelines on Safety for Natural Gas-fuelled Engine Installations in Ships.
2. MSC.313(88): Amendments to the Guidelines for the Application of Plastic Pipes on Ships.

**MSC Circulars**

1. MSC/Circ.353: Revised Guidelines for Inert Gas Systems.
2. MSC/Circ.387: Revised Guidelines for Inert Gas Systems.
3. MSC/Circ.450/Rev.1: Revised factors to be taken into consideration when designing cargo tanks venting and gas-freeing arrangements.
4. MSC/Circ. 451: Guidance concerning the location of fire control plans for the assistance of the shore side fire-fighting personnel.
5. MSC/Circ.553: Information on flashpoint and recommended fire-fighting media for chemicals to which neither the IBC nor BCH Codes apply.
6. MSC/Circ.670: Guidelines for the performance and testing criteria and surveys of high-expansion foam concentrates for fixed fire-extinguishing systems.
7. MSC/Circ.677: Revised standards for the design, testing and locating of devices to prevent the passage of flame into cargo tanks in tankers (as amended by MSC/Circ. 1009).
8. MSC/Circ.732: Interim guidelines on the test procedure for demonstrating the equivalence of composite materials to steel under the provisions of the 1974 SOLAS Convention.
9. MSC/Circ: 735: Recommendation on the design and operation of passenger ships to respond to elderly and disabled persons' needs.

10. MSC/Circ. 798: Guidelines for performance and testing criteria and surveys of medium-expansion foam concentrate for fixed fire-extinguishing systems.
11. MSC/Circ.849: Guidelines for the performance, location, use and care of emergency escape breathing devices (EEBDs).
12. MSC/Circ.895: Recommendation on helicopter landing areas in ro-ro passenger ships.
13. MSC/Circ.917/Corr.1: Guidelines on fire safety construction in accommodation areas.
14. MSC/Circ.1002/Corr.1: Guidelines on alternative design and arrangements for fire safety.
15. MSC/Circ.1003: Guidelines on a simplified calculation for the total amount of combustibile materials per unit area in accommodation and service spaces.
16. MSC/Circ.1009: Amendments to the revised standards for the design, testing and locating of devices to prevent the passage of flame into cargo tanks in tankers (MSC/Circ.677).
17. MSC/Circ.1070: Ship design, construction, repair and maintenance – Guidelines for the survey of repairs.
18. MSC/Circ.1086: Code of practice for atmospheric oil mist detectors.
19. MSC/Circ.1120: Unified interpretations of SOLAS Chapter II-2, the FSS Code, the FTP Code and related fire test procedures.
20. MSC/Circ.1129: Guidance on the establishment of medical and sanitation related to programmes for passenger ships.
21. MSC/Circ.1167: Functional requirements and performance standards for the assessment of evaluation guidance systems.
22. MSC/Circ.1168: Interim guidelines for the testing, approval and maintenance of evacuation guidance systems used as an alternative to the low-location lighting systems.
23. MSC.1/Circ.1238: Guidelines for evacuation analysis for new and existing passenger ships.
24. MSC.1/Circ.1239: Unified interpretations of SOLAS Chapter II-2.
25. MSC.1/Circ.1242: Guidelines for the approval of fixed fire detection and fire alarm systems for cabin balconies.
26. MSC.1/Circ.1266: Carriage of dangerous goods.
27. MSC.1/Circ.1268: Guidelines for the approval of fixed pressure water-spraying and water-based fire-extinguishing systems for cabin balconies.
28. MSC.1/Circ.1274: Guidelines for evaluation of fire risk of external areas on passenger ships.
29. MSC.1/Circ.1276: Unified interpretations of SOLAS Chapter II-2.
30. MSC.1/Circ.1312/Corr.1: Revised guidelines for the performance and testing criteria, and surveys of foam concentrates for fixed-fire-extinguishing systems.

31. MSC.1/Circ.1318: Guidelines for the maintenance and inspections of fixed carbon dioxide fire-extinguishing systems.
  32. MSC.1/Circ.1321: Guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms.
  33. MSC.1/Circ.1324: Amendments to the revised standards for the design, testing and location of devices to prevent the passage of flame into cargo tanks in tankers (MSC/Circ.677, as amended by MSC/Circ.1009).
  34. MSC.1/Circ.1368: Interim clarifications of SOLAS Chapter II-2 requirements regarding interrelation between the central control station, navigation bridge and safety centre.
  35. MSC.1/Circ.1369: Interim explanatory notes for the assessment of passenger ship systems' capabilities after a fire or flooding casualty.
  36. MSC.1/Circ.1370: Guidelines for the design, construction and testing of fixed hydrocarbon gas detection systems.
  37. MSC.1/Circ.1374: Information on prohibiting the use of asbestos on board the ships.
  38. MSC.1/Circ.1384: Guidelines for the testing and approval of fixed high-expansion foam systems.
  39. MSC.1/Circ.1388: Unified interpretation of Chapter 12 of the International Code for Fire Safety Systems.
  40. MSC.1/Circ.1395: List 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.
  41. MSC.1/Circ.1431: Guidelines for the approval of helicopter facility foam fire fighting appliance.
  42. MSC.1/Circ.1432: Revised guidelines for the maintenance and inspection of fire protection systems and appliances.
  43. MSC.1/Circ.Unified interpretations of the FTP Code.
  44. MSC.1/Circ.1437: Amendments to the interim explanatory notes for the assessment of passenger ship system capabilities after a fire or flooding casualty (MSC.1/Circ.1369).
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