RULES
FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS

PART V

FIRE PROTECTION

January
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GDAŃSK

RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS prepared and edited by Polish Register of Shipping*, 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	–	Ship and Machinery Piping Systems
Part VII	–	Main and Auxiliary Machinery and Equipment
Part VIII	–	Electrical Installations and Control Systems
Part IX	–	Materials and Welding.

Part V – Fire Protection – January 2024, was approved by the PRS Board on 21 December 2023 and enters into force on 1 January 2024.
From the entry into force, the requirements of this *Part V* apply, within the full scope, to new ships.
For existing ships, the requirements of this *Part V* are applicable within the scope specified in *Part I – Classification Regulations* and as specified in Part *Supplement – Retroactive Requirements*.

The requirements of this *Part V* are extended by the below-listed *Publications*:

Publication 12/P	–	Safety Requirements for Sea-going Ships Carrying Industrial Personnel
Publication 41/P	–	Symbols Related to Life-saving Appliances and Arrangements and Escape Routes. Guidelines for Passenger Safety Instructions.
Publication 51/P	–	Procedural Requirements for Service Suppliers.
Publication 72/P	–	Safety Requirements for Ships using Low Flashpoint Gases (LNG, CNG, LPG) as fuel.
Publication 90/P	–	Safe Return to Port and Orderly Evacuation and Abandonment of the Ship.
Publication 100/P	–	Safety Requirements for Sea-going Passenger Ships and High-speed Passenger Craft Engaged on Domestic Voyages.
Publication 118/P	–	Requirements for Passenger Ships Constructed of Polymer Composites, Engaged on Domestic Voyages.
Publication 122/P	–	Requirements for Baltic Ice Class Ships and Polar Class for Ships under PRS Supervision
Publication 29/I	–	Guidelines for Periodical Inspections of Fire-Extinguishing Systems and Appliances Used on Ships.
Publication 37/I	–	Guidelines for the Safety of Ships Using Fuel Cell Power Installations.
Publication 38/I	–	Guidelines for the Safety of Ships Using Methyl/ethyl Alcohol as Fuel.
Publication 39/I	–	Guidelines for the Safe Carriage of Alternative Fuelled Vehicles (AFVs) on Ro-ro Ships and n board Charging of Electric Vehicles.

External documents referred to in this *Part V* (IMO Resolutions and Circulars, IACS Resolutions, etc.) – see *List of external reference documents* at the end of the text.

* *Polish Register of Shipping means Polski Rejestr Statków S.A., seated in Gdańsk, al. gen. Józefa Hallera 126, 80-416 Gdańsk, Poland,* registered in the Register of Entrepreneurs of the National Court Register, under entry number 0000019880. Polish Register of Shipping, its affiliates and subsidiaries, their respective officers, employees or agents are, individually and collectively, referred to as Polish Register of Shipping or as PRS for short.

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CHAPTER 1

1 GENERAL PROVISIONS

1.1 Application and explanantion

1.1.1 *Part V – Fire Protection* (hereinafter referred to as *Part V*) of the *Rules* contains fire protection requirements and applies to all ship types to be assigned the main symbol **✻KM** or **✻K** of PRS class. Additional requirements for the assignment of additional marks in the symbol of class related to a specific ship type, specific structures, systems or equipment, are provided in *Chapter 11* and *Chapter 12* of this *Part V*.

1.1.2 *Part V* provides general requirements for fire-fighting systems. Detailed requirements for pipes, joints, bulkhead penetrations and supports as well as valves and other system components (i.e. compensators, flexible hoses, plastic pipes, etc.), including testing requirements, are provided in *Part VI – Ship and Machinery Piping Systems*.

1.1.3 If relaxation from some requirements of this *Part V* can be granted due to restricted or special service of a ship, relevant information can be found in particular paragraphs.

1.1.4 Requirements of external documents implemented into the *Rules* are marked with dedicated colours (see 1.1.5, 1.1.7 and 1.11.8) and provided with identification of the source material they came from. PRS' text is always in black colour

1.1.5 Latest editions of IACS resolutions (Unified Requirements – UR, Unified Interpretations – UI and Recommendations – REC.) concerning systems are incorporated and cited in this *Part V* in their original version where appropriate. Whenever the term Classification Society or Society appears in IACS resolutions it should be read as PRS.

1.1.6 IACS UIs will be applied by PRS to ships, whose flag Administrations have not issued definite instructions on the interpretation of the IMO regulations concerned.

1.1.7 Statutory requirements of SOLAS Convention and related FSS Code and other applicable IMO Codes, IMO resolutions and circulars concerning fire protection are incorporated and cited in this *Part V* in their original version where appropriate. Only the latest version of statutory requirements is cited.

1.1.8 Fire protection rules/requirements of UE Directives/Regulations have been implemented into this *Part V* and marked accordingly.

1.1.9 If some parts of the cited IACS resolutions or statutory technical requirements have been omitted due to their irrelevance in particular context, the omitted text is marked with (...). Where necessary, relevant PRS notes or additional requirements are inserted in the cited text in black colour.

1.1.10 Statutory technical requirements of SOLAS Convention incorporated into this *Part V* shall be applicable to ships in accordance with the provisions of this Conventions.

1.1.11 Statutory technical requirements cited in this *Part V* will not be considered as the condition for class assignment if PRS provides statutory services and certification to the ship on behalf of her flag Administration.

1.1.12 If following the provisions of SOLAS Convention flag Administration exempts a ship from any of the Convention technical requirements or accepts equivalent arrangements PRS will not demand compliance with the Convention original technical requirements cited in this *Part V*.

1.1.13 Whenever Conventions leave some technical arrangements to the discretion of flag Administrations PRS, acting as RO on behalf of a flag Administration, will make relevant decisions following provisions of Agreement with the Administration, otherwise will accept decisions made by the RO acting on behalf of the flag Administration. If the flag Administration of a newbuilding is unknown (not decided yet) PRS will make relevant decisions on its own.

1.1.14 PRS when acting as RO on behalf of any authorizing flag state Administration, may accept alternative design and arrangements to those required by IMO instruments and citied in this *Part V* in accordance with the rules specified in chapter 10 of this *Part V*.

1.2 Definitions

General terminology definitions used in the *Rules* are provided in *Part I – Classification Regulations*. Wherever, in this *Part V*, definitions provided in other *Parts* of the *Rules* are used, reference to these *Parts* is made.

For the purpose of this *Part V,* the following additional definitions apply:

.1 ***Accommodation spaces*** are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, game and hobby rooms, barber shops, pantries containing no cooking appliances* and similar spaces. (SOLAS II-2/3.1)

**** IMO interpretations***

Pantries or isolated pantries containing no cooking appliances may accommodate:

.1 toasters, microwave ovens, induction heaters and similar appliances each of them with a maximum power of 5 kW, and;

.2 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 ℃.

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. (MSC/Circ.1120, MSC.1/Circ.1436)

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

.1 they are constructed of steel or other equivalent material*;

**** IMO interpretation***

.1 "Light-weight constructions" (honeycomb type, etc.) of steel or equivalent material may be used as non-load-bearing internal "A" class division in accommodation and service spaces provided they have successfully passed the relevant standard fire test according to the FTP Code.

.2 These "light-weight constructions" should not be used as an integral part of main fire zone bulkheads and stairway enclosures on passenger ships. (MSC/Circ.1120)

.2 they are suitably stiffened;

.3 they are insulated* with approved non-combustible materials, such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 180°C above the original temperature, within 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,

*** IACS and IMO interpretation**

Insulated "A" class bulkheads and decks used on board ships, including the means of affixing the insulation to the "A" class structural members, shall be consistent with the materials, details and arrangements used during, and documented in the test reports issued for, the approval test for that insulating material. (IACS UI SC239, MSC.1/Circ.1434)

.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 the Administration has required a test of a prototype bulkhead or deck in accordance with the *FTP Code* to ensure that it meets the above requirements for integrity and temperature rise. (SOLAS II-2/3.2)

.2.1 ***Administration*** means the Government of the State whose flag the ship is entitled to fly. (FSS Code, Ch.2/1)

.3 ***Atriums*** are public spaces within a single main vertical zone spanning three or more open decks. (SOLAS II-2/3.3)

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

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

*** IACS interpretation**

A division consisting of a non-combustible core and combustible veneers may be accepted as a "B" or "C" class division, provided:

(1) that the non-combustible core is tested in accordance with the FTP Code, Annex 1, part 1,

(2) that the "B" class division is tested in accordance with the FTP Code, Annex 1, part 3, and

(3) that the veneers are tested in accordance with the FTP Code, Annex 1, part 5 and part 2, if applicable. (IACS UI SC125)

.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 the time listed below:
class "B-15" – 15 min,
class "'B-0" – 0 min,

.3 they are 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 the Administration has required a test of a prototype division in accordance with the *FTP Code* to ensure that it meets the above requirements for integrity and temperature rise. (SOLAS II-2/3.4)

.5 ***Bulkhead deck*** is the uppermost deck up to which the transverse watertight bulkheads are carried. (SOLAS II-2/3.5)

.6 ***Cargo area*** is that part of the ship that contains cargo holds, cargo tanks, slop tanks and cargo pump-rooms including pump-rooms, cofferdams, ballast and void spaces adjacent to cargo tanks and also deck areas throughout the entire length and breadth of the part of the ship over the above-mentioned spaces*. (SOLAS II-2/3.6)

* *Protection of fuel oil tanks:*

Interpretation concerning the determination of the cargo area in relation to empty spaces and ballast tanks protecting the ship's fuel oil tanks are given in MSC.1/Circ.1239 and IACS UI SC211.

.7 ***Cargo ship*** is any ship, which is not a passenger ship. (SOLAS II-2/3.7)

.8 ***Cargo spaces*** are spaces used for cargo, cargo oil tanks, tanks for other liquid cargo and trunks to such spaces. (SOLAS II-2/3.8)

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

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

.1 fixed fire detection and fire alarm systems;
.2 automatic sprinkler, fire detection and fire alarm systems;
.3 fire door indicator panels;
.4 fire door closure;
.5 watertight door indicator panels;
.6 watertight door closure;
.7 ventilation fans;
.8 general/fire alarms;
.9 communication systems* including telephones; and

* ***IMO interpretation***

The communication systems here mean only internal communication systems, which are required by the reg. (MSC/Circ.1120)

.10 microphones of public address systems. (SOLAS II-2/3.9)

.10 ***„C" class divisions*** are divisions constructed of approved non-combustible materials*. 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 this *Part V* (chapter). (SOLAS II-2/3.10)

* ***IACS interpretation***

A division consisting of a non-combustible core and combustible veneers may be accepted as a "B" or "C" class division, provided:

(1) that the non-combustible core is tested in accordance with the FTP Code, Annex 1, part 1,

(2) that the "B" class division is tested in accordance with the FTP Code, Annex 1, part 3, and

(3) that the veneers are tested in accordance with the FTP Code, Annex 1, part 5 and part 2, if applicable. (IACS UI SC125)

IMO interpretation

Adhesives used in the construction of the "C" class divisions are not required to be non-combustible; however, they are to have low flame-spread characteristics. (MSC/Circ.1120)

.11 ***Chemical tanker*** is a cargo ship constructed or adapted and used for the carriage in bulk of any liquid product of a flammable nature listed in chapter 17 of the *IBC Code*, as defined in *SOLAS* regulation VII/8.1. (SOLAS II-2/3.11)

.12 ***Closed ro-ro spaces*** are ro-ro spaces which are neither open ro-ro spaces nor weather decks. (SOLAS II-2/3.12)

.13 ***Closed vehicle spaces*** are vehicle spaces which are neither open vehicle spaces nor weather decks. (SOLAS II-2/3.13)

.14 ***Combination carrier*** is a cargo ship designed to carry both oil and solid cargoes in bulk. (SOLAS II-2/3.14)

.15 ***Combustible material*** is any material other than a non-combustible material. (SOLAS II-2/3.15)

.16 ***Continuous „B" class ceilings or linings*** are those "B" class ceilings or linings which terminate at an "A" or "B" class division. (SOLAS II-2/3.16)

.17 ***Continuously manned central control station*** is a central control station which is continuously manned by a responsible member of the crew. (SOLAS II-2/3.17)

.18 ***Control stations**** are those spaces in which the ship's radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment is centralized. Spaces where the fire recording or fire control equipment is centralized are considered to be a "fire control station". (SOLAS II-2/3.18)

***** IACS and IMO interpretation***

Explanation for control stations:

1 *Main navigational equipment includes, in particular, the steering stand and the compass, radar and position-finding equipment.*

2 *Steering gear rooms containing an emergency steering position are not considered to be control stations.*

3 *Where in the requirements of* this Part V *(reg. of chapter II-2) relevant to fixed fire-extinguishing systems there are no specific requirements for the centralization within a control station of major components of a system, such major components may be placed in spaces which are not considered to be a control station.*

4 *Spaces containing, for instance, the following battery sources should be regarded as control stations regardless of the battery capacity:*

.1 emergency batteries in separate battery room for power supply from black-out till start of the emergency generator;

.2 emergency batteries in separate battery room as reserve source of energy to radio installation;

.3 batteries for start of the emergency generator; and

.4 in general, all emergency batteries required in pursuance of SOLAS reg. II-1/42 or II-1/43 (IACS UI SC17, MSC/Circ.1120)

.19 ***Crude oil*** is any oil occurring naturally in the earth whether or not treated to render it suitable for transportation and includes crude oil where certain distillate fractions may have been removed from or added to. (SOLAS II-2/3.19)

.20 ***Dangerous goods*** are those goods referred to in the *IMDG Code*, as defined in *SOLAS* regulation VII/1.1. The division of the dangerous goods into classes is given in section 7.1. (SOLAS II-2/3.20)

.21 ***Deadweight*** is the difference in tones between the displacement of a ship in water of a specific gravity of 1.025 at the load waterline corresponding to the assigned summer freeboard and the lightweight of the ship. (SOLAS II-2/3.21)

.22 ***Fire Safety System Code (FSS Code)*** – means the International Code for Fire Safety Systems as adopted by the Maritime Safety Committee of the IMO by resolution MSC.98(73), as may be amended by the IMO, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the *SOLAS Convention* concerning the amendment procedures applicable to the annex other than chapter I thereof. (SOLAS II-2/3.22)

.23 ***Fire Test Procedure Code (FTP Code)**** – means the International Code for Application of Fire Test Procedures, 2010 (2010 FTP Code) as adopted by the Maritime Safety Committee of the IMO by resolution MSC.307(88), as may be amended by the IMO, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the *SOLAS Convention* concerning the amendment procedures applicable to the Annex other than chapter I. (SOLAS II-2/3.23)

* *FTP Code is valid with IMO interpretations/ recommendation contained in MSC.1/Circ.1319, MSC.1/Circ.1435 and IACS UI: FTP3, Rev.3, FTP4, Rev.2, FTP5, Corr.1 and FTP6, Rev.1*

.24 ***Flashpoint*** is the temperature in degrees Celsius (closed cup test) at which a product will give off enough flammable vapour to be ignited, as determined by an approved flashpoint apparatus. (SOLAS II-2/3.24)

.25 ***Gas carrier*** is a cargo ship constructed or adapted and used for the carriage in bulk of any liquefied gas or other products of a flammable nature, listed in chapter 19 of the *IGC Code,* as defined in *SOLAS* regulation VII/11.1. (SOLAS II-2/3.25)

.26 ***Helideck*** is a purpose-built helicopter landing area located on a ship including all structure, fire-fighting appliances and other equipment necessary for the safe operation of helicopters. (SOLAS II-2/3.26)

.27 ***Helicopter facilities*** is a helideck including any refueling and hangar facilities. (SOLAS II-2/3.27)

.28 ***Lightweight**** is the displacement of a ship in tones without cargo, fuel, lubricating oil, ballast water, fresh water and feedwater in tanks, consumable stores, and passengers and crew and their effects. (SOLAS II-2/3.28)

**** IACS interpretation***

The weight of mediums on board for the fixed fire-fighting systems (e.g. freshwater, CO_2, dry chemical powder, foam concentrate, etc.) shall be included in the lightweight and lightship condition. (IACS UI SC273)

.29 ***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*. (SOLAS II-2/3.29)

.30 ***Machinery spaces*** are machinery spaces of category A and other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and similar spaces*, and trunks to such spaces. (SOLAS II-2/3.30)

**** IACS and IMO interpretation***

In cases where urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS) are installed in a space separated from engine room, in determining fire integrity of divisions, the solution tank space should be considered as "similar spaces" and should be categorized as:

"(10) Tanks, voids and auxiliary machinery spaces having little or no fire risk" in SOLAS reg. 9.2.2.3.2.2, for ships carrying more than 36 passengers; or

"(7) Other machinery spaces" in SOLAS reg. 9.2.2.4.2.2, 9.2.3.3.2.2 or 9.2.4.2.2.2 for ships carrying not more than 36 passengers and cargo ships;

The division between the engine room and the solution tank space should have a fire integrity of at least "A-0" class. (IACS UI SC294, MSC.1/Circ.1616)

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

.1 internal combustion machinery used for main propulsion;

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

.3 any oil-fired boiler or oil fuel unit, or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc. (SOLAS II-2/3.31)

Note:
A space that cannot be entered independently of machinery spaces of category A shall also be regarded as a machinery space of category A.

.32 ***Main vertical zones*** are those sections 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. (SOLAS II-2/3.32)

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

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

.33 ***Non-combustible material*** is a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C, this being determined in accordance with the *FTP Code*. (SOLAS II-2/3.33)

.34 ***Oil fuel unit**** is the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18 N/mm^2 (SOLAS II-2/3.34)

**** IACS and IMO interpretation***

Oil fuel unit includes any equipment used for the preparation and delivery of oil fuel, heated or not, to boilers (including inert gas generators) and engines (including gas turbines) at a pressure of more than 0.18 N/mm^2. Oil fuel transfer pumps are not considered as oil fuel units. (IACS UI SC16, MSC.1/Circ.1203)

.35 ***Open ro-ro spaces*** are those ro-ro spaces that are either open at both ends or have an opening at one end, and are provided with adequate natural ventilation effective over their entire length through permanent openings distributed in the side plating or deckhead or from above, having a total area of at least 10% of the total area of the space sides. (SOLAS II-2/3.35)

.36 ***Open vehicle spaces*** are those vehicle spaces either open at both ends, or have an opening at one end and are provided with adequate natural ventilation effective over their entire length through permanent openings distributed in the side plating or deckhead or from above, having a total area of at least 10% of the total area of the space sides. (SOLAS II-2/3.36)

.36.1 ***Organization*** means International Maritime Organization (IMO)**.**

.37 ***Passenger ship*** is a ship which carries more than twelve passengers. (SOLAS II-2/3.37)

.38 ***Prescriptive requirements*** means the construction characteristics, limiting dimensions, or fire safety systems specified in this *Part V* (in parts B, C, D, E or G of *SOLAS Conv.*). (SOLAS II-2/3.38)

.39 ***Public spaces* are** those portions of accommodation spaces which are used for halls, dining rooms, lounges and similar permanently enclosed spaces. (SOLAS II-2/3.39)

.40 ***Rooms containing furniture and furnishings of restricted fire risk*** –for the purpose of fire integrity of adjacent spaces, are those rooms containing furniture and furnishings of restricted fire risk (whether cabins, public spaces, offices or other types of accommodation) in which:

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

.2 free-standing furniture such as chairs, sofas, tables, are 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^2, this being determined in accordance with the *FTP Code*;

.4 floor coverings have low flame-spread characteristics;

.5 exposed surfaces of bulkheads, linings and ceilings have low flame-spread characteristics;

.6 upholstered furniture has qualities of resistance to the ignition and propagation of flame, this being determined in accordance with *FTP Code*;

.7 bedding components have qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the *FTP Code*. (SOLAS II-2/3.40)

.41 ***Ro-ro spaces*** are spaces not normally subdivided in any way and normally extending to either a substantial length or the entire length of the ship in which motor vehicles with fuel in their tanks for their own propulsion and/or goods (packaged or in bulk, in or on rail or road cars, vehicles (including road or rail tankers), trailers, containers, pallets, demountable tanks or in or on similar stowage units or other receptacles) can be loaded and unloaded normally in a horizontal direction. (SOLAS II-2/3.41)

.42 ***Ro-ro passenger ship*** means a passenger ship with ro-ro spaces or special category spaces. (SOLAS II-2/3.42)

.43 ***Steel or other equivalent material*** means any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g. aluminium alloy with appropriate insulation). (SOLAS II-2/3.43)

.44 ***Sauna*** is a hot room with temperatures normally varying between 80°C – 120°C where the heat is provided by a hot surface (e.g. by an electrically-heated oven). The hot room may also include the space where the oven is located and adjacent bathrooms. (SOLAS II-2/3.44)

.45 ***Service spaces*** are those spaces used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, storerooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces. (SOLAS II-2/3.45)

**** IMO interpretation***

Main pantries and pantries containing cooking appliances may contain:

.1 toasters, microwave ovens, induction heaters and similar appliances each of them with a power of more than 5 kW; and

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

These pantries may also contain coffee machines, dish washers and water boilers with no exposed hot surfaces regardless of their power.

Spaces containing any electrically heated cooking plate or hot plate for keeping food warm with a power of more than 5 kW should be regarded as galleys. (MSC/Circ.1120, MSC.1/Circ.1436)

.46 ***Special category spaces*** are those enclosed vehicle spaces above and below the bulkhead deck, into and from which vehicles can be driven and to which passengers have access. Special category spaces may be accommodated on more than one deck provided that the total overall clear height for vehicles does not exceed 10 m. (SOLAS II-2/3.46)

.47 ***Standard fire test*** is a test in which specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time- temperature curve in accordance with the test method specified in *FTP Code*. (SOLAS II-2/3.47)

.48 ***Tanker*** is a cargo ship constructed or adapted for the carriage in bulk of liquid cargoes of flammable nature. (SOLAS II-2/3.48)

In context of these Unified Requirements, oil tankers shall be considered as vessels capable of carrying oil having a flash point not exceeding 60°C (closed cup test). (IACS UR F6)

.49 ***Vehicle spaces*** are cargo spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion. (SOLAS II-2/3.49)

.50 ***Weather (open) deck*** is a deck which is completely exposed to the weather from above and from at least two sides. (SOLAS II-2/3.50)

.51 ***Safe area*** in the context of a fire casualty, from the perspective of habitability, any area(s), 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. (SOLAS II-2/3.51)

.52 ***Safety centre*** is a control station dedicated to the management of emergency situations. Safety systems' operation, control and/or monitoring are an integral part of the safety centre. (SOLAS II-2/3.52)

.53 ***Cabin balcony*** is an open deck space which is provided for the exclusive use of the occupants of a single cabin and has direct access from such a cabin. (SOLAS II-2/3.53)

.54 ***Fire damper*** is a device installed in a ventilation duct, which under normal conditions remains open allowing flow in the duct, and is closed during a fire, preventing the flow in the duct to restrict the passage of fire. In using the above definition the following terms may be associated:

- **.1** ***automatic fire damper*** is a fire damper that closes independently in response to exposure to fire products;
- **.2** ***manual fire damper*** is a fire damper that is intended to be opened or closed by the crew by hand at the damper itself; and
- **.3** ***remotely operated fire damper*** is a fire damper that is closed by the crew through a control located at a distance away from the controlled damper. (SOLAS II-2/3.54)

.55 ***Smoke damper*** is a device installed in a ventilation duct, which under normal conditions remains open allowing flow in the duct, and is closed during a fire, preventing the flow in the duct to restrict the passage of smoke and hot gases. A smoke damper is not expected to contribute to the integrity of a fire rated division penetrated by a ventilation duct. In using the above definition the following terms may be associated:

- **.1** ***automatic smoke damper*** is a smoke damper that closes independently in response to exposure to smoke or hot gases;
- **.2** ***manual smoke damper*** is a smoke damper intended to be opened or closed by the crew by hand at the damper itself; and
- **.3** ***remotely operated smoke damper*** is a smoke damper that is closed by the crew through a control located at a distance away from the controlled damper. (SOLAS II-2/3.55)

.56 ***Vehicle carrier**** means a cargo ship which only carries cargo in ro-ro spaces or vehicle spaces, and which is designed for the carriage of unoccupied motor vehicles without cargo, as cargo. (SOLAS II-2/3.56)

***** IMO interpretation***

The definition of vehicle carrier is intended for pure car and truck carriers, and should exclude other types of ro-ro cargo ships or container/ro-ro ships, even when carrying empty cars and trucks as cargo. (MSC.1/Circ.1555)

.57 ***Helicopter landing area*** is an area on a ship designated for occasional or emergency landing of helicopters but not designed for routine helicopter operations. (SOLAS II-2/3.57)

.58 ***Winching area*** is a pick-up area provided for the transfer by helicopter of personnel or stores to or from the ship, while the helicopter hovers above the deck. (SOLAS II-2/3.58)

Definitions concerning possibility of ignition:

.59 ***Auto-ignition point*** means the temperature at which a substance will spontaneously combine with oxygen and burn without an external ignition or heat source. (MSC.1/Circ.1321)

.60 ***Flammable liquids*** are liquids, liquid mixtures and suspended solids (liquid fuels, paints, varnishes, etc.), which give off flammable vapours having a flash-point not exceeding 60°C, determined in closed cup test.

.61 ***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, also involve the phenomenon of glowing;
- ***Group B*** – fires of flammable liquids, such as diesel oil, petrol, alcohols or fusible solid substances, 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.

.62 ***Heated surfaces*** means surfaces with a high temperature source on the other side. (MSC.1/Circ.1321)

.63 ***High temperature surfaces*** means surfaces with temperatures above 220°C. (MSC.1/Circ.1321)

.64 ***Hot surfaces*** means 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 and exhaust gas boilers. (MSC.1/Circ.1321)

.65 ***Lower flammable/ explosive limit (LFL)*** is 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. (PN-ISO 8421-1:1997)

.66 ***Low-flashpoint fuel*** means gaseous or liquid fuel having a flashpoint lower than otherwise permitted under paragraph 2.1.1 of *SOLAS* regulation II-2/4. (IGF Code)

.67 ***Potential ignition sources*** are 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. (MSC.1/Circ.1321)

.68 ***Upper flammable/ explosive limit*** is maximum concentration of flammable agent in air (or other oxidizing agent) above which the mixture will not ignite. (PN-ISO 8421-1:1997)

.69 ***Readily ignitable materials*** are 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.

Definitions concerning fire prevention/ extinguishing

.70 ***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, also involve 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.

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

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

.73 ***Structural fire protection*** – all passive means of fire protection intended for:
- preventing the fire hazard;
- confining/retarding the spread of fire and smoke on the ship;
- ensuring safe evacuation of crew/ passengers from individual spaces and from the ship, as well as access to particular spaces during rescue and fire-fighting operations.

1.3 Classification documentation

Prior to the commencement of the ship construction, the below listed technical documentation, unless in this *Part V* stated otherwise, shall be submitted to PRS Head Office for consideration and approval. In the case of ships, which undergo modifications, the below listed documentation is subject to consideration and approval in the scope which covers the modifications.

1.3.1 Technical documentation

A. Structural fire protection, covering:

1. plan of structural fire protection, specifying the adopted fire protection method, names and fire hazard categories of the spaces, including:
- arrangement of “A”, “B” and “C” fire class divisions, taking into account closing and openings in these divisions;
- arrangement of draught stops;
- construction details of the fire class divisions;
- arrangement and marking of escape routes;
- solutions for typical penetrations of piping, cables and ventilation ducts through fire divisions;

2. plan of fire doors, including fire door controls;

3. plan of windows and sidescuttles;

4. plan of ship’s spaces insulation;

5. plan of deck covering;

6. plan for the equipment of ship’s spaces, including:
- linings of walls and ceilings;
- floor coverings;

– list of upholstered furniture, suspended textiles and bedding components (for passenger ships);

7. painting plan of ship's spaces;

8. calculating the fire load (total amount of combustible materials used in accommodation, service spaces and control stations), if provided;

9. plan of ventilation and air-conditioning systems, including the arrangement of ventilation ducts, air inlets and outlets and fire dampers;

10. plan of escape routes (with the given clear width of staircases and corridors);

11. plan of low-location lighting and marking of escape routes (for passenger ships);

12. evacuation analyses (for passenger ships);

13. arrangement of safety centre (for passenger ships);

14. documentation confirming compliance with the requirements for safe return to port in the context of fire casualty (for passenger ships of 120 m or more or having three or more main vertical zones);

15. list of required certificates for materials/components/structures of fire divisions used.

B. Active fire protection, covering plans/diagrams/lists of:

.1 water fire main system, including the calculation of the selection of fire pumps capacities, hydraulic calculations of the required pressure at hydrants, the arrangement of fire pumps, pipelines, isolating valves and hydrants;

.2 automatic sprinkler, fire detection and fire alarm system or high-pressure equivalent sprinkler system (water mist), together with calculations of the necessary water demand, required pressure at sprinklers, diagram of the system operation with alarm signalling, drawing of pressure tank, the arrangement of sprinkler pumps, pressure tank, pipe lines, section valves and sprinklers, with division into pipe sections;

.3 pressure water-spraying/ water mist fire-extinguishing system for machinery spaces and cargo pump-rooms, including calculations of pumps capacities, hydraulic calculations of the required pressure at spraying nozzles, arrangement of pumps, section valves, pipelines and nozzles, location of pipeline sections;

.4 pressure water-spraying fire-extinguishing system for cargo spaces, including the calculations of pumps capacities, hydraulic calculations of the required pressure at spraying nozzles, arrangement of pumps, section valves, pipelines and nozzles, location of pipeline sections;

.5 local application water-based fire-extinguishing system for machinery spaces of category A, including calculations of pumps capacities, hydraulic calculations of the required pressure at spraying nozzles, diagram of the system operation, including alarm signalling, arrangement of pumps, section valves, pipelines and nozzles, location of pipe sections;

.6 local application water-based fire-extinguishing system for exhaust gases fired oil boilers, including calculations of the necessary water supply, arrangement of valves, piping and nozzles, drainage arrangement;

.7 water-spraying fire-extinguishing system for container ships with open-top container holds, including calculations of the necessary water supply, arrangement of valves, piping and nozzles,

.8 water screen system, including the calculations of water supplies, arrangement of section valves, pipelines and nozzles (if provided);

.9 fire-extinguishing system for the protection of galley exhaust duct and deep-fat cooking equipment;

.10 fixed deck foam system, including calculations of the required amount of foam concentrate, hydraulic calculations of pipe diameters, system operation diagram, arrangement of pipes and system devices, such as: foam concentrate tanks, foam proportioners, foam monitors and foam generators (for tankers);

.11 carbon dioxide (CO_2) system or equivalent fixed gas fire-extinguishing system, including calculations of the required amount of extinguishing agent, selection of pipes and nozzles diameters based on flow hydraulic calculations, calculation of discharge time for each protected spaces, diagram of the system operation, together with warning signalling, layout of agent cylinders, starting devices, arrangement of pipes and nozzles, operation manual;

.12 fixed high-expansion foam system, including calculations of the required amount of foam concentrate, hydraulic calculations of pipe diameters, system operation diagram, arrangement of pipes and system devices, such as: foam concentrate tanks, foam proportioners and control of the system (if provided);

.13 aerosol 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, arrangement of aerosol generators/ cylinders, pipes and nozzles, operation manual (if provided);

.14 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 (for chemical tankers and gas tankers);

.15 inert gas system, 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, material specifications, electrical diagrams of control and monitoring the inert gas parameters, automation and alarms(for tankers, chemical carriers and gas tankers);

.16 hydrocarbon gas detection system in ship compartments, hydrocarbon gas/flammable gas continuous monitoring system in cargo pump rooms, including the location of gas measurement and analysis panel, pipes and smoke accumulators, as well as electric circuits diagrams(required for tankers and chemical tankers);

.17 gas detection system, including the location of gas measurement and analysis panel, pipes and smoke accumulators, as well as electric circuits diagrams(for gas tankers);

.18 fire detection and fire alarm system, including electric circuits diagrams, division into sections, the arrangement of control panel, indicating units, detectors and manually operated call points;

.19 sample extraction smoke detection system, including the location of smoke detection control panel, indicating units, pipes and smoke accumulators, electric circuits diagrams (if provided);

.20 arrangement of fire-protection equipment, i.e. portable and mobile fire-extinguishers, portable foam applicator units, fire-fighter's equipment and emergency escape breathing apparatus;

.21 fire-extinguishing system for paint lockers and flammable liquid lockers;

.22 list of the required certificates for the applied components, appliances, systems and fire-fighting equipment;

.23 onboard test program of fire extinguishing systems, fire detection and fire alarm systems, as well as gas detection systems.

C. Appliances and equipment posing additional risk of fire, covering:

.1 plan of helicopter facilities, including fire-extinguishing systems and helideck equipment;

.2 plan of tanks and distributing stations for fuel with a flash-point below 43°C;

.3 plan of welding gases system;

.4 plan of liquefied gasouse system for domestic purposes.

Classification documentation shall contain material specifications, list of machinery and 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.

1.3.2 Fire Control Plan

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

.1 the arrangement of "A" and "B" class divisions, as well as fire doors in these divisions;

.2 control stations/ safety centres 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 protected by fire detection and fire alarm systems (indicating the type of fire detectors: smoke, heat or flame detectors) and hydrocarbon gas detection systems, as well as showing the arrangement of manually operated call points and general alarm call points, control panel/ indicating unit and hydrocarbon gas detection system control panel;

.5 ship spaces/ areas protected by fixed fire-extinguishing systems (indicating the type of fire-extinguishing medium: CO_2, gas, foam, dry powder, water, sprinkler or water mist) and showing the arrangement of: fire-extinguishing medium storage tanks/ cylinders, high-expansion foam delivery ducts, monitors (water, foam and powder monitors), shut-off section valves, water fire main systems and foam fire-extinguishing systems isolating valves, fire hydrants, shore connections, as well as remote control positions for these systems;

.6 the arrangement of fire-fighting equipment: portable and mobile fire-extinguishers (indicating the type of fire-extinguishing medium), portable foam applicators, fire hoses (water, foam and powder) with nozzles, water fog applicators, fire-fighter's outfit sets, fire axes, emergency escape breathing devices (EEBD), as well as chemical protective clothing and additional breathing apparatus required when dangerous goods are carried;

.7 the arrangement of closures of ventilation openings (inlet and outlet) of the spaces, the location of fire dampers in ventilation ducts, positions of remote shutting off ventilating fans, remote closures of ventilation openings of spaces, remote control of fire dampers in ventilation ducts (indicating the type of served spaces: accommodation spaces, machinery spaces and cargo spaces), as well as fans serving each fire zone, together with a list of their identification numbers;

.8 fuel and lubricating oil tanks, located outside the double bottom, the positions of remote control of the tanks shut-off valves and stopping oil fuel and lubricating oil pumps;

.9 main and emergency fire pumps, positions of remote control of the main and emergency fire pumps, positions of remote control of fire pumps valves, positions of remote control of main and emergency bilge pumps;

.10 emergency electrical source of power (generating set or accumulator battery), as well as emergency switchboard;

.11 position of remote control of watertight doors, fire doors and machinery casing skylights;

.12 inert gas systems appliances in tankers;

.13 the location of containers, in which *Fire* Control *Plan*, intended for the shoreside fire-fighting personnel, are stored;

.14 assembly/ muster stations for passengers and crew;

.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;

.16 means/ compressors for recharging the breathing apparatus air cylinders.

Fire Control Plan should show the ship's profile with indicated deck levels, showing the arrangement of main vertical and horizontal fire divisions and primary and secondary means of escape.

In the table of symbols, the number of the required fire-fighting devices 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.

1.3.2.2 The graphic symbols used in *Fire Control Plan* shall conform to the symbols given in IMO Res. A.952(23) and in Res. A.1116(30), all the descriptions shall be in the official language of the Flag State.

1.3.2.3 *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. (SOLAS II-2/15.2.4.1)

1.3.2.4 Alternatively, at the discretion of the Administration, the aforementioned details may be set out in a booklet, a copy of which shall be supplied to each officer, and one copy shall at all times be available on board in an accessible position. Plans and booklets shall be kept up to date; any alterations thereto shall be recorded as soon as practicable. Description in such plans and booklets shall be in the language or languages required by the Administration. If the language is neither English nor French, a translation into one of those languages shall be included. (SOLAS II-2/14.2.4.1)

1.3.2.5 A duplicate of *Fire Control Plan* or a booklet containing such plans shall be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shore-side fire-fighting personnel*. (SOLAS II-2/14.2.4.2)

* Refer to *Guidance concerning the location of fire control plans for assistance of shoreside fire-fighting personnel* (MSC/Circ.451).

1.3.2.6 The location of each enclosure with *Fire Control Plan* shall be indicated with the symbol used on *Fire Control Plan*.

1.3.2.7 *Fire Control Plan* shall be approved by the Flag State Maritime Administration or organization (RO) acting on behalf of the Administration.

1.3.2.8 *Fire Control Plan* shall be marked with with IMO ship identification number.

1.3.3 Maintenance and safe operation documentation

Cargo ships of 500 gross tonnage and upwards and passenger ships (all ships subject to SOLAS Conv.) shall carry the following documentation:

.1 *Fire protection systems and appliances maintenance plan (*for short *Maintenance plan);*
.2 *Fire training manual*;
.3 *Fire safety operational booklet.*

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

1.3.3.1 Maintenance plan

1.3.3.1.1 *Maintenance plan* shall be kept on board the ship and shall be available for inspection whenever required by the Administration. (SOLAS II-2/14.2.2.2)

1.3.3.1.2 *Maintenance plan* shall include at least the following fire protection systems and fire-fighting systems and appliances, where installed:

.1 fire mains, fire pumps and hydrants, including hoses, nozzles and international shore connections;
.2 fixed fire detection and fire alarm systems;
.3 fixed fire-extinguishing systems and other fire extinguishing appliances;
.4 automatic sprinkler, fire detection and fire alarm systems;
.5 ventilation systems, including fire and smoke dampers, fans and their controls;
.6 emergency shut down of fuel supply;
.7 fire doors, including their controls;
.8 general emergency alarm systems;
.9 emergency escape breathing devices;
.10 portable and mobile fire extinguishers including spare charges; and
.11 fire-fighter's outfit; (SOLAS II-2/14.2.2.3)
.12 smoke management systems and smoke extraction systems of escape routes on passenger ships, if provided.

1.3.3.1.3 *Maintenance plan* may be computer-based. (SOLAS II-2/14.2.2.4)

1.3.3.1.4 In addition to the fire protection systems and appliances listed in par. 1.3.3.1.2 (SOLAS par. 2.2.3), passenger ships carrying more than 36 passengers shall develop a *Maintenance plan* for low-location lighting and public address systems. (SOLAS II-2/14.3)

1.3.3.1.5 In addition to the fire protection systems and appliances listed in par. 1.3.3.1.2 (SOLAS par. 2.2.3), tankers shall develop a *Maintenance plan* for:

.1 inert gas systems;
.2 deck foam systems;
.3 fire safety arrangements in cargo pump-rooms; and
.4 flammable gas detectors. (SOLAS II-2/14.4)

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

1.3.3.1.7 *Maintenance plan* shall also take into account the guidelines specified in MSC.1/Circ.1318/ Rev.1, MSC.1/Circ.1432, with the amendments given in MSC.1/Circ.1516.

1.3.3.2 Fire training manual

1.3.3.2.1 *Training manual* shall be provided in each crew mess room and recreation room or in each crew cabin. (SOLAS II-2/15.2.3.1)

1.3.3.2.2 *Training manual* shall be written in the working language of the ship. (SOLAS II-2/15.2.3.2)

1.3.3.2.3 *Training manual*, which may comprise several volumes, shall contain the instructions and information required in par. 1.3.3.2.4 (SOLAS par. 2.3.4) in easily understood terms and illustrated wherever possible. Any part of such information may be provided in the form of audio-visual aides in lieu of the manual. (SOLAS II-2/15.2.3.3)

1.3.3.2.4 *Training manual* shall explain the following in detail:

.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 meanings of the ship's alarms;
.4 operation and use of fire-fighting systems and appliances;
.5 operation and use of fire doors;
.6 operation and use of fire and smoke dampers;
.7 escape (evacuation) systems and appliances. (SOLAS II-2/15.2.3.4)

1.3.3.2.5 Additionally, *Training manual* shall also contains instruction on the duties assigned to particular crew members and organization of fire teams responsible for fire-extinguishing activity. (SOLAS II-2/15.2.1)

1.3.3.3 Fire safety operational booklet

1.3.3.3.1 The required *Fire safety operational booklet* shall contain the necessary information and instructions for the safe operation of the ship and cargo handling operations in relation to fire safety. *The booklet* shall include information concerning the crew's responsibilities for the general fire safety of the ship while loading and discharging cargo and while underway. Necessary fire safety precautions for handling general cargoes shall be explained. For ships carrying dangerous cargoes goods 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 *IMSBC Code, IBC Code, IGC Code and IMDG Code*, as appropriate. (SOLAS II-2/16.2.1)

1.3.3.3.2 *Fire safety operational booklet* shall be provided in each crew mess room and recreation room or in each crew cabin. (SOLAS II-2/16.2.2)

1.3.3.3.3 *Fire safety operational booklet* shall be written in the working language of the ship. (SOLAS II-2/16.2.3)

1.3.3.3.4 *Fire safety operational booklet* may be combined with *Training manual,* required in sub-chapter 1.3.3.2 (SOLAS reg. 15.2.3). (SOLAS II-2/16.2.4)

1.3.3.3.5 For tankers, the *Fire safety operational booklet* shall include provisions for preventing fire spread to the cargo area due to ignition of flammable vapours and include procedures of cargo tank gas-purging and/ or gas-freeing, as well as operation of inert gas system, contained in SOLAS, reg. II-2/16.3. (SOLAS II-2/16.3.1)

1.4 Scope of survey

1.4.1 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.*

1.4.2 Fire protection structures, 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, are subject to PRS survey during ship construction or alteration.

1.4.3 For ships of 500 gross tonnage and upwards and in all passenger ships engaged on international voyages (i.e. ships subject to SOLAS Conv.) and flying the flag of EU Member State, the following components of fire-protection equipment/ devices/ systems are subject to the procedures for the assessment of compliance (certification) for compliance with Commission Implementing Regulation (EU) 2022/1157 of 4 July 2022, laying down rules for the application of Directive 2014/90/EU of the European Parliament and of the Council, as regards design, construction and performance requirements and testing standards for marine equipment and repealing Implementing Regulation (EU) 2021/1158, hereinafter referred to as "MED Directive":

- **.1** "A", "B" and "C" class divisions; (MED/3.11a, 3.11b, 3.64)
- **.2** Fire doors; (MED/3.16)
- **.3** Fire door control systems components; (MED/3.17)
- **.4** "A" and "B" class fire proof windows and side scuttles; (MED/3.25)
- **.5** Non-combustible materials; (MED/3.13)
- **.6** Primary deck covering; (MED/3.1)
- **.7** Surface materials and floor coverings with low flame-spread characteristics: decorative veneers, paint systems, floor coverings, pipe insulation covers, adhesives used in "A", "B" and "C" class divisions, combustible ducts membrane; (MED/3.18a, 3.18b, 3.18c, 3.18d, 3.18e, 3.18f)
- **.8** Draperies, curtains and other suspended textile materials and films; (MED/3.19)
- **.9** Upholstered furniture: complete piece of furniture (including cover material, filling material and non- combustible rack), cover material for any filling material, cover material for flame-retardant filling material (tested in specific combination as intended for further application), flame-retardant filling material; (MED/3.20a, 3.20b, 3.20c, 3.20d)
- **.10** Bedding components; (MED/3.21)
- **.11** Fire dampers; (MED/3.22)
- **.12** Penetrations through "A" class divisions: electric cable transits, pipes, ducts, trunk etc. penetrations, busbar trunking penetration systems; (MED/3.26a, 3.26b, 3.26c)
- **.13** Penetrations through "B" class divisions: electric cable transits, pipes, ducts trunk , etc. penetrations; (MED/3.27a, 3.27b)
- **.14** Sprinkler systems (limited to sprinkler heads); (MED/3.28)
- **.15** Sprinkler systems components for accommodation spaces, service spaces and control stations equivalent to that referred to in SOLAS 74 Reg. II-2/12 (limited to nozzles and their performance); (MED/3.9)
- **.16** Nozzles for fixed pressure water spraying fire extinguishing systems for machinery spaces and cargo pump-rooms; (MED/3.10)
- **.17** Nozzles for equivalent water-mist fire extinguishing systems for machinery spaces and cargo pump rooms; (MED/3.39)
- **.18** Fixed water-based spraying fire- fighting systems for use in ro-ro spaces, vehicle spaces and special category spaces: prescriptive-based systems as per Circ.1430/Rev.3, performance-based systems as per IMO MSC.1/Circ. 1430/Rev.3; (MED/3.49a, 3.49b)
- **.19** Fixed water-based local application fire-fighting systems components for use in category A machinery spaces (nozzles and performance tests); (MED/3.48)
- **.20** Nozzles for deep-fat cooking equipment fire-extinguishing systems (automatic or manual type); (MED/3.43)

.21 Nozzles for fixed pressure water-spraying fire-extinguishing systems for cabin balconies; (MED/3.60)
.22 Equivalent fixed gas fire-extinguishing systems components (extinguishing medium, head valves, and nozzles) for machinery spaces and cargo pump-rooms; (MED/3.45)
.23 Equivalent fixed gas fire-extinguishing systems for machinery spaces (aerosol systems); (MED/3.46)
.24 Medium-expansion fixed deck foam fire-extinguishing system components: fixed deck foam for tankers; (MED/3.57)
.25 Fixed low-expansion foam fire-extinguishing system components for machinery spaces and tank deck protection; (MED/3.58)
.26 Concentrates for fixed high-expansion foam fire-extinguishing systems for machinery spaces and cargo pump-rooms; (MED/3.47)
.27 Expansion foam for fixed fire-extinguishing systems for chemical tankers; (MED/3.59)
.28 Inside air high expansion foam systems for the protection of machinery spaces, cargo pump rooms, vehicle and ro-ro spaces, special category spaces and cargo spaces; (MED/3.61a)
.29 Outside air high expansion foam systems for the protection of machinery spaces, cargo pump rooms, vehicle and ro-ro spaces, special category spaces and cargo spaces; (MED/3.61b)
.30 Fixed oxygen analysis and/or gas detection equipment: category 4: (safe area), category 3: (explosive gas atmospheres); (MED/3.54a, 54b)
.31 Portable oxygen analysis and gas detection equipment: category 1: (safe area), category 2: (explosive gas atmospheres); (MED/3.30a, 30b)
.32 Inert gas systems: whole system; (MED/3.42a)
.33 Inert gas systems: single components: inert gas scrubbers, inert gas blowers; (MED/3.42b, 3.42c)
.34 Low-location lighting systems (components only); (MED/3.40)
.35 Fire-fighting hoses: non-percolating lay-flat hoses (range of inside diameter from 25 to 52 mm), semi-rigid hoses for fixed systems; (MED/3.29, 3.70)
.36 Fire-fighting hose system: hose reels with semi-rigid hose, hose systems with lay-flat hose; (MED 3.56, 3.71)
.37 Dual-purpose type nozzles (spray/ jet type): hand-held branch pipes for fire service use - combination branch pipes PN 16, hand-held branch pipes for fire service use - smooth bore jet and/or one fixed spray jet angle branch pipes PN 16; (MED/3.55a, 55b)
.38 Portable, non-portable and transportable fire-extinguishers; (MED/3.2, 3.52)
.39 Portable fire-extinguishing equipment for lifeboats and rescue boats; (MED/3.38)
.40 Fire-fighter's outfit: protective clothing (close proximity clothing): non reflective, reflective, with a reflective outer surface; (MED/3.3a, 3.3b, 3.3c)
.41 Fire-fighter's outfit: boots, gloves, helmet, lifeline; (MED/3.4, 3.5, 3.6, 3.44)
.42 Self-contained compressed-air-operated breathing apparatus. Lifelines for breathing apparatus; (MED/3.7, 3.44)
.43 Emergency escape breathing devices (EEBD): self-contained open-circuit compressed air breathing apparatus with full mask or mouthed piece assembly for escape, self-contained open-circuit compressed air breathing apparatus with a hood for escape, self-contained closed-circuit com-pressed air breathing apparatus; (MED/3.41a, 3.41b, 3.41c)
.44 Fixed fire detection and fire alarm systems components for accommodation and service spaces, control stations, cabin balconies, machinery spaces and unattended machinery spaces: control and indicating equipment, power supply equipment, fire detectors: heat detectors- point detectors, smoke detectors: point detectors using scattered light, transmitted light or ionization, flame detectors: point detectors, manual call points, short circuit isolators, input/output devices, cables; (MED/3.51a, 3.51b, 3.51c, 3.51d, 3.51e, 3.51f, 3.51g, 3.51h, 3.51i)

.45 Fire alarm devices: sounders; (MED/3.53)
.46 Dry chemical powder extinguishing systems; (MED/3.62)
.47 Sample extraction smoke detection systems components: control and indicating equipment (Electrical installations in ships), power supply equipment, components aspiring smoke detectors; (MED/3.63a. 63b, 63c)
.48 Fixed hydrocarbon gas detection system; (MED/3.65)
.49 Evacuation guidance systems used as an alternative to low-location lighting systems; (MED/3.66)
.50 Helicopter facility foam fire-fighting appliances; (MED/3.67)
.51 Galley exhaust duct fixed fire extinguishing systems components; (MED/3.68)
.52 Mobile water monitors for ships designed to carry five or more tiers of containers on or above the weather deck. (MED/3.69)

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

1.4.4 For ships of less than 500 gross tonnage and for passenger ships not engaged on international voyages (not subject to SOLAS Conv.), as well as for ships flying the flag of non-EU Member State, the fire-protection equipment/ devices/ systems, listed in par. 1.4.3, shall be of the type approved by PRS (shall have *Type Approval Certificate* issued by PRS).

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

1.4.5 The following components of fire-protection equipment/ devices/ systems used in fire protection, not covered by par. 1.4.3, based on "MED Directive", part 9, shall be of the type approved by PRS:
.1 Fixed gas fire-extinguishing systems (CO_2) components: cylinders provided with valves, distribution valves (with an activating device), non-return valves, flexible pipe assemblies, time-delay units, discharge nozzles; (MED/9/3.27)
.2 Paint lockers and flammable liquid lockers fire extinguishing systems components; (MED/9/3.21)
.3 Water spraying hand operated system; (MED/9/3.31)
.4 Electric safety lamps; (MED/9/3.8)
.5 Protective clothing resistant to chemical attack; (MED/9/3.9)
.6 Portable foam applicator units; (MED/9/3.24)
.7 Fire hoses with nominal diameter > 52 mm; (MED/9/3.33)
.8 Alcohol-resistant foam system; (MED/9/3.74)
.9 Fire-extinguishing systems flexible connections;
.10 Plastic pipes and piping components used in fire-extinguishing systems.

1.4.6 PRS may agree to a one-time acceptance of a fire structure, material or fire-fighting system, for which type approval is required, for installation on board a given ship, provided that tests and acceptance survey are carried out in accordance with the previously agreed test and acceptance program, confirmed by the issue of *Test/ Inspection Certificate*.

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

1.4.8 Cylinders and pressure vessels of CO_2 gas fire-extinguishing systems and high pressure CO_2 manifolds, are subject to acceptance and pressure tests at the manufacturer's in the presence of PRS' Surveyor.

1.4.9 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 29/I – Guidelines for Periodical Inspections of Fire-extinguishing Systems and Appliances Used on Ships*.

1.4.10 Inspections, maintenance and repairs of fixed fire-extinguishing systems, fire-fighting equipment (fire-extinguishers and portable foam applicator units), breathing apparatus, EEBD-s, low-location lighting systems and laboratory tests of foam concentrates, shall be performed by service stations approved by PRS.

1.4.11 Service stations applying for PRS approval shall comply with requirements contained in *Publication 51/P – Procedural Requirements for Service Suppliers*.

CHAPTER 2

2 STRUCTURAL FIRE PROTECTION OF SHIPS

2.1 Ship construction

2.1.1 Material of 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 "steel or other equivalent material", as specified in par. 1.2.43 (SOLAS reg. II-2/3.43), the "applicable fire exposure" shall be according to the integrity and insulation standards given in the appropriate tables relating to fire integrity of divisions (tables 9.1 to 9.4). For example, where divisions such as decks or sides and ends of deckhouses are permitted to have "B-0" fire integrity, the "applicable fire exposure" shall be half an hour. (SOLAS II-2/11.2)

2.1.2 Structure of aluminium alloy*

Unless otherwise specified in par. 2.1.1 (SOLAS par. 2), in cases where any part of the structure is of aluminium alloy, the following shall apply:

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

.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:

.2.1 that for such members supporting lifeboat and liferaft areas and "A" class divisions, the temperature rise limitation, specified in sub-par .1 (SOLAS par. 3.1) shall apply at the end of one hour; and

.2.2 that for such members required to support "B" class divisions, the temperature rise limitation, specified in sub-par .1 (SOLAS par. 3.1) shall apply at the end of half an hour. (SOLAS II-2/11.3)

*** *IACS interpretation***

Insulation of aluminium decks and interpretation of "load-bearing divisions":

1 *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.*

2 *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;*

3 *"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. (MSC/Circ.1120)*

2.1.3 Fire protection materials

Note:
Examples of the use of materials and finishes in accommodation spaces on cargo and passenger ships - see IACS UI SC126.

2.1.3.1 Use of non-combustible materials

2.1.3.1.1 Insulating materials

Insulating materials shall be non-combustible, except in cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces. Vapour barriers and adhesives used in conjunction with insulation, as well as the insulation of pipe fittings for cold service* systems, need not be of non-combustible materials, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame spread characteristics. (SOLAS II-2/5.3.1.1)

*** IACS and IMO interpretation**
Cold service is understood to mean refrigeration systems and chilled water piping for air conditioning systems. (IACS UI SC102 and MSC/Circ.1120)

2.1.3.1.2 Insulation surfaces protected against oil penetration

In spaces where penetration of oil products is possible, the surface of insulation* shall be impervious to oil or oil vapours. (SOLAS II-2/4.4.3)

*** IACS interpretation**
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. (MSC/Circ.1120)

2.1.3.1.3 Ceilings and linings

In cargo ships, 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* is specified, as referred to in par. 2.2.2.1 (SOLAS reg. 9.2.3.1); and

.2 in corridors and stairway enclosures serving accommodation spaces, service spaces and control stations for ships where *Method IIC* and *IIIC* are specified, as referred to in par. 2.2.2.1 (SOLAS reg. 9.2.3.1). (SOLAS II-2/5.3.1.2.2)

2.1.3.1.4 Waste receptacles

Waste receptacles* shall be constructed of non-combustible materials with no openings in the sides or bottom. (SOLAS II-2/4.4.2)

*** IACS and IMO interpretation**
This regulation is not intended to preclude the use of containers constructed of combustible materials in galleys, pantries, bars, garbage handling or storage spaces and incinerator rooms provided they are intended purely for the carriage of wet waste, glass bottles and metal cans and are suitably marked. (IACS UI SC166 and MSC/Circ.1120)

2.1.3.1.5 Prohibition of the use of asbestos

Based on SOLAS Conv., reg. II-1/3-5, the use of insulation materials and construction elements with insulation containing asbestos is prohibited, see MSC.1/Circ.1374/Rev.1.
Insulating materials and construction elements with insulation, such as: ceiling, floor and wall in accommodation areas, fire doors, etc., should be provided by the manufacturer with an asbestos-free declaration, as specified in Appendix 7 to the "2015 Guidelines for the Development of the Inventory of Hazardous Materials" (Res. MEPC.269(68)). (MSC.1/Circ.1426/Rev.1) and (IACS UI SC249, Rev.1)

2.1.3.2 The use of combustible materials

2.1.3.2.1 General

In cargo ships, non-combustible bulkheads, ceilings and linings fitted in accommodation and service spaces 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 of par. 2.1.3.2.2 to 2.1.3.2.6 (SOLAS reg. 5.3.2.2 to 5.3.2.4 and reg. 6). (SOLAS II-2/5.3.2.1.2)

2.1.3.2.2 Maximum calorific value of combustible materials

Combustible materials used on the surfaces and linings specified in par. 2.1.3.2.1 (SOLAS reg. 5.3.2.1) shall have a calorific value* not exceeding 45 MJ/m^2 of the area for the thickness used. The requirements of this paragraph are not applicable to the surfaces of furniture fixed to linings or bulkheads. (SOLAS II-2/5.3.2.2)

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.

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* Refer to the recommendations published by the International Organization for Standardization, in particular ISO/DIS 1716, *Reaction to fire tests for building and transport products - Determination of the heat of combustion.*

2.1.3.2.3 Total volume of combustible materials

Where combustible materials are used in accordance with par. 2.1.3.2.1 (SOLAS reg. 5.3.2.1), they shall comply with the following requirements:

.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 walls 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 sub-chapter 3.3 (FSS Code), the above volume may include some combustible materials used for erection of "C" class divisions. (SOLAS II-2/5.3.2.3)

2.1.3.2.4 Low flame-spread characteristics of exposed surfaces

The following surfaces shall have low flame-spread characteristics in accordance with *FTP Code*:

2.1.3.2.4.1 In passenger ships – see par.4.1.2.2.2.

2.1.3.2.4.2 In cargo ships:

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

.2 surfaces and grounds in concealed or inaccessible spaces in accommodation and service spaces and control stations. (SOLAS II-2/5.3.2.4)

*** *IACS interpretation***

Exposed surfaces are those of bulkheads, decks, floor coverings, wall linings and ceilings as appropriate. The requirement described within this regulation is not meant to apply to plastic pipes, electric cables, and furniture. (MSC/Circ.1120)

Note:

For examples of material application and surface coatings, see IACS UI SC126.

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

2.1.3.2.5 Paints, varnishes and other finishing

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*. (SOLAS II-2/6.2.1)

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* ***IACS and IMO interpretation***

Exposed interior surfaces are those of bulkheads, decks, floor coverings, wall linings and ceilings as appropriate. The requirement described within this regulation is not meant to apply to plastic pipes, electric cables, and furniture. (MSC/Circ.1120)

This regulation only applies to accommodation spaces, service spaces and control stations as well as stairway enclosures. (IACS UI SC127)

Note:
For examples of the use of materials and finishes in accommodation spaces on cargo and passenger ships – see IACS UI SC126.

2.1.3.2.6 Primary deck coverings

Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of approved material which will not give rise to smoke or toxic or explosive hazards at elevated temperatures, this being determined in accordance with the *FTP Code*. (SOLAS II-2/6.3.1)

Note:
For examples of the use of materials and finishes in accommodation spaces on cargo and passenger ships – see IACS UI SC126.

2.1.4 Machinery spaces of category A

2.1.4.1 Crowns and casings

Crowns and casings of machinery spaces of category A shall be of steel construction and shall be insulated as required by tables 9.5 and 9.7, as appropriate. (SOLAS II-2/11.4.1)

2.1.4.2 Floor plating

The floor plating of normal passageways in machinery spaces of category A shall be made of steel. (SOLAS II-2/11.4.2)

2.1.4.3 Protection of openings in machinery spaces boundaries

2.1.4.3.1 Application

The provision of this paragraph shall apply to machinery spaces of category A and, where the Administration considers it desirable, to other machinery spaces. (SOLAS II-2/9.5.1.1)

2.1.4.3.2 Protection of openings in machinery space boundaries

2.1.4.3.2.1 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. (SOLAS II-2/9.5.2.1)

2.1.4.3.2.2 Skylights shall be made of steel and shall not contain glass panels. (SOLAS II-2/9.5.2.2)

2.1.4.3.2.3 Means of control shall be provided for closing power-operated doors or actuating release mechanisms on doors other than power-operated watertight doors. The control shall be located outside the space concerned, where they will not be cut off in the event of fire in the space it serves. (SOLAS II-2/9.5.2.3)

2.1.4.3.2.4 Windows shall not be fitted in machinery space boundaries. However, this does not preclude the use of glass in control rooms within the machinery spaces. (SOLAS II-2/9.5.2.6)

2.1.4.4 Means of control in machinery spaces

2.1.4.4.1 Means of control shall be provided for opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation and closure of ventilator dampers. (SOLAS II-2/5.2.2.1)

2.1.4.4.2 Means of control shall be provided for stopping ventilating fans. Controls provided for the power ventilation serving machinery spaces shall be grouped so as to be operable from two positions, one of which shall be outside such spaces. The means provided for stopping the power ventilation of the machinery spaces shall be entirely separate from the means provided for stopping ventilation of other spaces. (SOLAS II-2/5.2.2.2)

2.1.4.4.3 Means of control shall be provided for stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service pumps, thermal oil circulating pumps and oil separators (purifiers). However, par. 2.1.4.4.4 (SOLAS 5.2.2.4) need not apply to oily water separators. (SOLAS II-2/5.2.2.3)

Controls required by this regulation should also be provided from the compartment itself. (IACS UR F35)

2.1.4.4.4 The controls* required in par. 2.1.4.4.1 to 2.1.4.4.3 (SOLAS par. 5.2.2.1 to 5.2.2.3) and in reg. 4.2.2.3.4) shall be located outside the space concerned so they will not be cut off in the event of fire in the space they serve. (SOLAS II-2/5.2.2.4)

***** ***IMO interpretation***

In machinery spaces of category A, controls to close off ventilation ducts and pipes should be installed with due regard to the hot gases produced by a fire in the space concerned. *(MSC/Circ.1120)*

2.1.4.4.5 The location of means of control in machinery spaces should be indicated with the symbol used on *Fire Control Plan*.

2.1.5 Accommodation and service spaces

2.1.5.1 Accommodation and service areas shall be separated from machinery spaces.

2.1.5.2 Air spaces enclosed behind ceilings, paneling or linings shall be divided by close-fitting draught stops* spaced not more than 14 m apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., shall be closed at each deck. (SOLAS II-2/8.4)

Note:
* Draught stops are tight barriers designed to prevent the spread of smoke and fire, as well as to prevent stoking the fire by the inflow of air in air spaces beyond the formwork of ceilings and walls that are normally invisible during ship service.

**** IMO interpretation***

Construction and location of draught stops:

1 Any of the following methods of construction may be used to construct draught stops:

.1 the extension of the "B" Class bulkhead, ceiling or lining;

.2 the extension of the "C" Class bulkhead, ceiling or lining;

.3 1 mm thick minimum steel sheet, stiffened where necessary, intermittently welded to the ship's structure and the top profile of the bulkhead, or fastened mechanically to the ceilings or linings;

.4 non-combustible board type material fastened mechanically to the ship's structure, bulkheads, ceilings or linings; or

.5 non-combustible 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 may be 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 Draught stops are not required in public spaces with open ceilings (perforated ceilings) with openings of 40% or more. (MSC/Circ.1120)

2.2 Thermal and structural boundaries

Ships of all types shall be subdivided into spaces by thermal and structural divisions having regard to the fire risks of the space. (SOLAS II-2/9.2.1)

2.2.1 Construction of the fire divisions

"A", "B" and "C" class divisions shall be so constructed as to comply with definitions 2.1.66, 2.1.67 and 2.1.68, respectively.

Construction of onboard made "A" class divisions, with regard to the use of insulating materials, the method of fixing these materials to the bulkhead or deck and the arrangement of fasteners, shall be in accordance with the fire tests report carried out as part of the type approval procedure of the "A" class division. The fire test report shall contain the information specified in MSC.1/Circ.1435.

2.2.2 Methods of protection in accommodation area

2.2.2.1 One of the following methods of protection shall be adopted in accommodation and service spaces and control stations:

.1 Method IC

The construction of internal divisional bulkheads of non-combustible "B" or "C" class divisions generally without the installation of an automatic sprinkler, fire detection and fire alarm system in the accommodation and service spaces, except as required by par. 6.1.1.1.1 (SOLAS reg. 7.5.5.1); or

.2 Method IIC

The fitting of an automatic sprinkler, fire detection and fire alarm system as required by par. 6.1.1.1.2 (SOLAS reg. 7.5.5.2) for the detection and extinction of fire in all spaces in which fire might be expected to originate, generally with no restriction on the type of internal divisional bulkheads; or

.3 Method IIIC

The fitting of a fixed fire detection and fire alarm system as required by regulation par. 6.1.1.1.3 (SOLAS reg. 7.5.5.3), in spaces in which a fire might be expected to originate, generally with no restriction on the type of internal divisional bulkheads, except that in no case must the area of any accommodation space or spaces bounded by an "A" or "B" class division exceed 50 m^2. Consideration may be given by the Administration to increasing this area for public spaces.* (SOLAS II-2/9.2.3.1.1)

*** IMO interpretation**

The area of public spaces may be permitted to increase up to 75 m². *(MSC/Circ.1120)*

2.2.2.2 The requirements for the use of non-combustible materials in the construction and insulation of boundary bulkheads of machinery spaces, control stations, service spaces, etc., and the protection of the above stairway enclosures and corridors will be common to all three methods outlined in par. 2.2.2.1 (SOLAS par. 2.3.1.1) (SOLAS II-2/9.2.3.1.2)

2.2.3 Bulkheads within accommodation area

2.2.3.1 Bulkheads required to be "B" class divisions shall extend from deck to deck and to the shell or other boundaries. However, where a continuous "B" class ceiling or lining is fitted on both sides of the bulkhead, the bulkhead may terminate at the continuous ceiling or lining. (SOLAS II-2/9.2.3.2.1)

2.2.3.2 Method IC

Bulkheads not required by this or other regulations for cargo ships to be "A" or "B" class divisions, shall be of at least "C" class construction. (SOLAS II-2/9.2.3.2.2)

2.2.3.3 Method IIC

There shall be no restriction on the construction of bulkheads not required by this or other regulations for cargo ships to be "A" or "B" class divisions except in individual cases where "C" class bulkheads are required in accordance with table 9.5. (SOLAS II-2/9.2.3.2.3)

2.2.3.4 Method IIIC

There shall be no restriction on the construction of bulkheads not required for cargo ships to be "A" or "B" class divisions except that the area of any accommodation space or spaces bounded by a continuous "A" or "B" class division must in no case exceed 50 m², except in individual cases where "C" class bulkheads are required in accordance with table 9.5. Consideration may be given by the Administration to increasing this area for public spaces*. (SOLAS II-2/9.2.3.2.4)

*** IMO interpretation**

The area of public spaces may be permitted to increase up to 75 m². *(MSC/Circ.1120)*

2.2.4 Fire integrity of bulkheads and decks

2.2.4.1 In addition to complying with the specific provisions for fire integrity of bulkheads and decks of ships, the minimum fire integrity of bulkheads and decks shall be as prescribed in table 9.5 and 9.6. (SOLAS II-2/9.2.3.3.1)

For ships of less than 500 gross tonnage – see sub-chapter 9.3.

2.2.4.2 The following requirements shall govern application of the tables:

.1 table 9.5 and 9.6 shall apply respectively to the bulkheads and decks separating adjacent spaces;

.2 For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (11) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this regulation, or where it is possible to assign two or more classifications to a space, it shall be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30% communicating openings to that space are considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms shall be as prescribed in tables 9.5 and 9.6. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables;

(1) **Control stations*:**

- spaces containing emergency sources of power and lighting;
- wheelhouse and chartroom;
- spaces containing the ship's radio equipment;
- fire control stations;
- control rooms for propulsion machinery when located outside the machinery space;
- spaces containing centralized fire alarm equipment.

***** ***IMO and IACS interpretations***

A bulkhead separating the wheelhouse and the toilet, installed completely within the wheelhouse, requires no fire rating. (MSC.1/Circ.1555)

A navigation locker that can only be accessed from the wheelhouse should be considered as a control station and the bulkhead separating the wheelhouse and such a locker should have fire integrity of at least "B-0" class. (MSC.1/Circ.1581)

Navigation equipment room (radar transmitter) and battery rooms should be treated as category (1): Control Stations. (IACS UI SC45)

(2) **Corridors:**

- corridors and lobbies.

(3) **Accommodation spaces*:**

- spaces as defined in par. 1.2.1 (SOLAS reg. 3.1), excluding corridors.

***** ***IMO interpretations***

Pantries or isolated pantries containing no cooking appliances may contain:

.1 toasters, microwave ovens, water boilers, induction heaters and similar appliances each of them with a maximum power of 5 kW; and

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

These pantries may also contain coffee machines, dish washers and water boilers with no exposed hot surfaces regardless of their power.

A dining room containing such appliances should not be regarded as a pantry. (MSC/Circ.1120 and MSC.1/Circ.1436)

(4) **Stairways:**

- interior stairway, lifts, totally enclosed emergency escape trunks, and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto.

  In this connection, a stairway which is enclosed only at one level shall be regarded as part of the space from which it is not separated by a fire door.

(5) **Service spaces (low risk)*:**

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

*** IMO and IACS interpretations**

Distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provisions made for storage.

If distribution boards are located in an identifiable space having a deck area of less than 4 m²,this space may be categorized in (5). (IACS UI SC167, MSC/Circ.1120)

Provision chambers are to be treated as store rooms.

Refrigerated provision chambers are to be category (5) service spaces if thermally insulated with non-combustible materials. (IACS UI SC45)

(6) **Machinery spaces of category A:**

- spaces as defined in par. 1.2.31 (SOLAS reg.3.31).

(7) **Other machinery spaces*:**

- electrical equipment rooms (auto-telephone exchange, air-conditioning duct spaces);
- spaces as defined in par. 1.2.30 (SOLAS reg. 3.30), excluding machinery spaces of category A.

*** IMO and IACS interpretations**

In cases where urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS) are installed in a space separated from the engine-room, in determining fire integrity of divisions, the solution tank space should be considered as "similar spaces" in the definition of "machinery spaces" in par. 1.2.30 (SOLAS reg. 3.30) and should be categorized as (7): "Other machinery spaces".

The division between the engine-room and the solution tank space should have a fire integrity of at least "A-0" classand (IACS UI SC294, MSC.1/Circ.1616)

(8) **Cargo spaces:**

- all spaces used for cargo (including cargo oil tanks) and trunk ways and hatchways to such spaces.

(9) **Service spaces (high risk)*:**

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

*** IACS interpretation**

Provision chambers are to be treated as store rooms.

Refrigerated provision chambers are to be category (9) service spaces if thermally insulated with combustible materials. (IACS UI SC45)

(10) **Open decks:**

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

(11) Ro-ro and vehicle spaces

- ro-ro spaces as defined in par. 1.2.41 (SOLAS reg. 3.41);
- vehicle spaces as defined in par. 1.2.49 (SOLAS reg. 3.49).

Table 9.5**
Fire integrity of bulkheads separating adjacent spaces

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

Table 9.6**
Fire integrity of decks separating adjacent spaces

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

- Note: to be applied to tables 9.5 and 9.6 as appropriate.

a) No special requirements are imposed upon bulkheads in *methods IIC and IIIC* fire protection.

b) In case of *method IIIC*, “B” class bulkheads of “B-0” rating shall be provided between spaces or groups of spaces of 50 m² and over in area.

c) For clarification as to which applies, see sec. 2.2.3 and 2.2.5 (SOLAS reg. 2.3.2 and 2.3.4).

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

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

f) An "A-0" rating may be used 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, par. 7.2.8 (SOLAS reg. 19.3.8) applies.

h) Deleted.

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

** *For the definition of machinery spaces having little or no fire risk in footnote "i" see par.11.1.2.3.2(10) (SOLAS reg. 9.2.2.3.2.2 (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 should 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.

** ***IMO interpretations to tables 9.5 and 9.6 regarding ro-ro spaces and vehicle spaces:***

1 Decks and bulkheads:

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

2 Hatches:

Class "A" fire integrity respectively does not apply to hatches fitted on open deck adjacent to ro-ro/vehicle spaces and on decks separating ro-ro/vehicle spaces, provided that such hatches are constructed of steel.

3 Access doors:

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

4 Movable ramps:

Movable ramps installed on decks referred to in Interpretation1 above which form boundaries of "A-30" fire integrity shall be constructed of steel and shall be insulated to "A-30" fire integrity, except for the "working parts" of such movable ramps (e.g. hydraulic cylinders, associated pipes/accessories) and members supporting such fittings which do not contribute to the structural strength of the boundary. Such movable ramps need not be subject to fire test. This is applicable to non-watertight doors used for loading/unloading of vehicles.

5 Ventilation ducts:

Where ducts for a ro-ro/vehicle spaces pass through other ro-ro/vehicle spaces without serving those spaces, each duct shall be insulated all along itself to "A-30" fire integrity in ways of other ro-ro/vehicle spaces unless the sleeves and fire dampers in compliance with SOLAS reg. II-2/9.7.3.1 in order to prevent spread of fire through the ducts are fitted.

6 Ventilators:

"A-0" fire integrity does not apply to ventilators constructed of steel fitted on open decks adjacent to ro-ro/vehicle spaces. (MSC.1/Circ.1511)

2.2.4.3 Continuous "B" class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing, wholly or in part, to the required insulation and integrity of a division. (SOLAS II-2/9.2.3.3.3)

2.2.4.4 External boundaries which are required in par. 2.1.1 (SOLAS reg. 11.2) to be of steel or other equivalent material may be pierced for the fitting of windows and sidescuttles provided that there is no requirement for such boundaries to have "A" class fire integrity. Similarly, in such boundaries which are not required to have "A" class integrity, doors may be constructed of materials which are to the satisfaction of the Administration. (SOLAS II-2/9.2.3.3.4)

2.2.4.5 Saunas*, if provided, shall comply with sec. 11.1.2.3.4 (SOLAS par. 2.2.3.4). (SOLAS II-2/9.2.3.3.5)

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* *The space categories mentioned in SOLAS reg. 9.2.2.3.4.1 should be replaced, when applying this regulation, to categories (5), (7) and (10). (MSC/Circ.1120)*

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

2.2.5.1 Stairways which penetrate only a single deck shall be protected, at a minimum, at one level by at least "B-0" class divisions and self-closing doors. Lifts which penetrate only a single deck shall be surrounded by "A-0" class divisions with steel doors at both levels. 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 self-closing doors at all levels*. (SOLAS II-2/9.2.3.4.1)

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* The required protection of stairways penetrating more than a single deck can be achieved by:

.1 a stairway enclosure allowing access from one stair to a superimposed stair within such enclosure, the entrances to which should consist self-closing "A" class fire doors at each deck level (see figure 1 of reg. 9.2.3.4.1 in the appendix of MSC/Circ.1120); or

.2 a stairway enclosure enclosing the stairs only, in combination with self-closing "A" class fire doors at each deck-level and at each end of a stair. No requirements apply to the stairs except that they should be of steel frame structure or be made of equivalent material (see figure 2.1 of reg. 9.2.3.4.1 in the appendix of MSC/Circ.1120); or

.3 stairways that penetrate only one single deck should be protected, at a minimum, at one level by at least “B-0” class division and self-closing doors (see figure 2.2 of reg. 9.2.3.4.1 in the appendix of MSC/Circ.1120).

IMO and IACS interpretation

Dumb-waiters shall be regarded as lifts. (IACS UI SC46, MSC/Circ.1120)

2.2.5.2 On ships having accommodation for 12 persons or less, where stairways penetrate more than a single deck and where there are at least two escape routes direct to the open deck at every accommodation level, the "A-0" requirements of par. 2.2.5.1 (SOLAS 9.2.3.4.1) may be reduced to "B-0". (SOLAS II-2/9.2.3.4.2)

2.2.6 Penetration in fire-resisting divisions and prevention of heat transmission

2.2.6.1 Requirements for pipes, trunks, ventilation ducts penetration in “A” and ”B” fire class divisions are given in sub-chapter 1.9 of *Part VI*.

2.2.6.2 Requirements for ventilation ducts penetration in “A” and ”B” fire class divisions are given in sub-chapter 7.2 of *Part VI*.

2.2.6.3 Where "A" class divisions are penetrated, such penetrations shall be tested in accordance with *FTP Code*, subject to the provisions of par.11.1.3.1.6 (SOLAS par. 9.4.1.1.6). In the case of ventilation ducts, par. 7.2.2 and 7.4.1 of *Part VI* (SOLAS par. 9.7.1.2 and 9.7.3.1) apply. However, where a pipe penetration is made of steel or equivalent material having a thickness of 3 mm or greater and a length of not less than 900 mm (preferably 450 mm on each side of the division), and no openings, testing is not required. Such penetrations shall be suitably insulated by extension of the insulation at the same level of the division. (SOLAS II-2/9.3.1)

IMO interpretations

This regulation should be applied to all penetrations at the exterior boundaries of superstructures and deckhouses which, according to par. 11.6.3.2.5 (SOLAS reg. II-2/9.2.4.2.5), are required to be "A-60" class insulated. (MSC.1/Circ.1203)

Reference is made to resolution A.753(18) - Guidelines for the application of plastic pipes on ships, as amended by MSC.313(88) and MSC.399(95). (MSC/Circ.1120).

2.2.6.4 Where "B" class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc., or for the fitting of ventilation terminals, lighting fixtures and similar devices, arrangements shall be made to ensure that the fire resistance is not impaired, subject to the provisions of par. 7.4.2 of *Part VI* (SOLAS par. 9.7.3.2). Pipes other than steel or copper that penetrate "B" class divisions shall be protected by either:

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

.2 a steel sleeve, having a thickness of not less than 1.8 mm and a length of not less than 900 mm for pipe diameters of 150 mm or more and not less than 600 mm for pipe diameters of less than 150 mm (preferably equally divided to each side of the division). The pipe shall be connected to the ends of the sleeve by flanges or couplings; or the clearance between the sleeve and the pipe shall not exceed 2.5 mm; or any clearance between pipe and sleeve shall be made tight by means of non-combustible or other suitable material. (SOLAS II-2/9.3.2)

2.2.6.5 Uninsulated metallic pipes penetrating "A" or "B" class divisions shall be of materials having a melting temperature which exceeds 950°C for "A-0" and 850°C for "B-0" class divisions. (SOLAS II-2/9.3.3)

2.2.6.6 In approving structural fire protection details, the Administration shall have regard to the risk of heat transmission* at intersections and terminal points of required thermal barriers shall have been regarded. The insulation of a deck or bulkhead shall be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of "A" class standard having insulation of different values, the insulation with the higher value shall continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm. (SOLAS II-2/9.3.4)

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* ***IMO interpretation***

Prevention of heat transmission by insulation and structural details for drainage:

1 Details of measures to be adopted for avoiding heat transmission at intersections and terminal points of insulation of decks or bulkheads are given in figures 1 and 2 of reg. 9.3.4 in the appendix of MSC/Circ.1120.

Alternative details may be accepted provided that the effectiveness of such design is verified by an appropriate test in the same manner as those specified in the FTP Code.

2 In the case where the lower part of insulation has to be cut for drainage, the construction should be in accordance with the structural details as given in figure 3 for reg. 9.3.4 in the appendix of MSC/Circ.1120. (MSC/Circ.1120)

2.2.7 Protection of openings in fire resisting divisions

2.2.7.1 Doors in fire-resisting divisions*

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* ***IACS interpretation***

Balancing openings or ducts between two enclosed spaces are prohibited except for openings as permitted by this paragraph (SOLAS Reg. II-2/9.4.1.2 and II-2/9.4.2). (IACS UI SC119)

2.2.7.1.1 The fire resistance of doors shall be equivalent to that of the division* in which they are fitted, this being determined in accordance with *FTP Code*. Doors and door frames in "A" class divisions shall be constructed of steel**. Doors in "B" class divisions shall be non-combustible. Doors fitted in boundary bulkheads of machinery spaces of category A shall be reasonably gastight and self-closing. In ships constructed according to method IC, the Administration may permit the use of combustible materials in doors separating cabins from individual interior sanitary accommodation such as showers. Doors approved as "A" class without the sill being part of the frame shall be installed such 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. Doors approved as "B" class without the sill being part of the frame shall be installed such that the gap under the door does not exceed 25 mm. (SOLAS II-2/9.4.2.1)

IMO interpretations

* *Where required divisions are replaced by divisions of a higher standard, the door need only conform to the required division.*

** *Steel or equivalent material is acceptable for the construction of doors and door frames in "A" class divisions. (MSC/Circ.1120)*

2.2.7.1.2 Doors required to be self-closing shall not be fitted with hold-back hooks. However, hold-back arrangements fitted with remote release devices of the fail-safe type may be utilized. (SOLAS II-2/9.4.2.2)

2.2.7.1.3 In corridor bulkheads ventilation openings may be permitted in and under the doors of cabins and public spaces. Ventilation openings are also permitted in "B" class doors leading to lavatories, offices, pantries, lockers and store rooms. Except as permitted below, the openings shall be provided only in the lower half of a door. Where such an opening is in or under a door the total net area of any such opening or openings shall not exceed 0.05 m^2. Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, and located below the sanitary unit is permitted where the cross-sectional area of the duct does not exceed 0.05 m^2. Ventilation openings, except those under the door, shall be fitted with a grille made of non-combustible material. (SOLAS II-2/9.4.2.3)

2.2.7.1.4 Watertight doors need not be insulated*. (SOLAS II-2/9.4.2.4)

**** IACS interpretation***

Watertight doors may also serve as fire doors but need not be fire-tested notwithstanding the fire resistance of the division in which the watertight doors are fitted. (...) (IACS UI SC156)

2.3 Means of escape* in cargo ships

**** IMO interpretation***

Locking arrangements and accessibility to embarkation decks:

1 *The escape routes are routes for escape and also for access. Accordingly, the locking arrangement should be such that it does not obstruct these two objectives (escape and access). Doors along any designated escape routes which require keys to unlock them when moving in the direction of escape,* during the ship is in service, *should not be permitted.*

2 *The embarkation deck should be accessible from the open decks to which escapes routes lead. (MSC/Circ.1120)*

2.3.1 General requirements

2.3.1.1 A general emergency alarm system required by *Part VIII*, sub-chapter 7.4 (SOLAS reg. III/6.4.2) shall be used for notifying crew and passengers of a fire, to enabling them safe evacuation in first stage of fire. (SOLAS II-2/12.2)

2.3.1.2 The purpose of this sub-chapter 2.3 (regulation) is to provide requirements for means of escape so that persons onboard can safely and swiftly escape* to the lifeboat and liferaft embarkation deck. (SOLAS II-2/13.1)

**** IACS and IMO interpretation***

To facilitate a swift and safe means of escape to the lifeboat and liferaft embarkation deck, the following provisions apply to overhead hatches fitted along the escape routes:

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 should 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. (IACS UI SC247, MSC.1/Circ.1456)

2.3.1.3 Unless expressly provided otherwise in this sub-chapter 2.3 (regulation), at least two widely separated and ready means of escape shall be provided from all spaces or group of spaces. (SOLAS II-2/13.2.1)

2.3.1.4 Lifts shall not be considered as forming one of the means of escape as required by this sub-chapter 2.3 (regulation). (SOLAS II-2/13.2.2)

2.3.1.5 The lift cabin should ensure safe evacuation of persons, also in the emergency conditions. The lift cabin should incorporate an escape hatch at the top of at least 500 x 500 mm to enable evacuation when the lift cabin stops between deck levels in the event of power failure. It should only be possible to open this hatch from the outside, using a special key kept in a box by the hatch. The lift shafts should be provided with a steel ladder allowing evacuation of the persons, through escape hatch, to the nearest landing.

2.3.1.6 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, shall be marked with escape route signs complying with Res. A.1116(30), leading to assembly/ muster stations. Such signs should be placed at eye level of an adult person.

These signs shall be of photoluminescent material or of other material and properly illuminated by electrical system supplied from the emergency source of power.

2.3.1.7 Escape routes shall be provided with lighting supplied from the main and the emergency source of power, see *Part VIII*.

2.3.2 Means of escape from control stations, accommodation and service spaces

2.3.2.1 General requirements

2.3.2.1.1 At all levels of accommodation there shall be provided at least two widely separated means of escape from each restricted space or group of spaces. (SOLAS II-2/13.3.3.1)

2.3.2.1.2 Stairways and ladders shall be so arranged as to provide ready means of escape to the lifeboat and liferaft embarkation deck from passenger and crew accommodation spaces and from spaces in which the crew is normally employed, other than machinery spaces. (SOLAS II-2/13.3.1.1)

2.3.2.1.3 Unless expressly provided otherwise in this sub-chapter 2.3 (regulation), a corridor, lobby, or part of a corridor from which there is only one route 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 athwartship supply corridors, shall be permitted, provided such dead-end corridors are separated from crew accommodation areas and are inaccessible from passenger accommodation areas. Also, a part of a corridor that has a depth not exceeding its width is considered a recess or local extension and is permitted. (SOLAS II-2/13.3.1.2)

2.3.2.1.4 All stairways in accommodation and service spaces and control stations shall be of steel frame construction or of other equivalent material. (SOLAS II-2/13.3.1.3)

2.3.2.1.5 If a radiotelegraph station has no direct access to the open deck, two means of escape from or access to, the station shall be provided, one of which may be a porthole or window of sufficient size for crew member escape. (SOLAS II-2/13.3.1.4)

2.3.2.1.6 Doors in escape routes shall, in general, open in-way of the direction of escape, except that:

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

.2 doors in vertical emergency escape trunks may open out of the trunk in order to permit the trunk to be used both for escape and for access. (SOLAS II-2/13.3.1.5)

2.3.2.2 Escape from spaces below the lowest open deck*

Below the lowest open deck the main means of escape shall be a stairway and the second escape may be a trunk or a stairway. (SOLAS II-2/13.3.3.2)

*** *IACS and IMO interpretation***

The "lowest open deck" shall be a category (10) "Open deck" (as defined in sub-chapter 2.2.4 (SOLAS chapter II-2, reg. 9.2.3.3.2.2 and 9.2.4.2.2.2)) at the lowest height from baseline in way of accommodation spaces. (IACS UI SC278, MSC.1/Circ.1511)

2.3.2.3 Escape from spaces above the lowest open deck

Above the lowest open deck the means of escape shall be stairways or doors to an open deck or a combination thereof. (SOLAS II-2/13.3.3.3)

2.3.2.4 Dead-end corridors

No dead-end corridors having a length of more than 7 m shall be accepted. (SOLAS II-2/13.3.3.4)

Note:
Dead-end corridor means a corridor or its part from which there is only one means of escape.

2.3.2.5 Width and continuity of escape routes

Stairways and corridors used as means of escape shall be not less than 700 mm in clear width and shall have a handrail on one side. Stairways and corridors with a clear width of 1,800 mm and over shall have handrails on both sides. "Clear width" is considered the distance between the handrail and the bulkhead on the other side or between the handrails. The angle of inclination of stairways should be, in general, 45°, but not greater than 50°, and in machinery spaces and small spaces not more than 60°. Doorways which give access to a stairway shall be of the same size as the stairway. (FSS Code, Ch. 13/3)

2.3.2.6 Dispensation from two means of escape

Exceptionally, the Administration 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. (SOLAS II-2/13.3.3.6)

2.3.2.7 Emergency escape breathing devices (EEBD)

2.3.2.7.1 Emergency escape breathing devices shall comply with sub-chapter 5.5 (FSS Code). Spare emergency escape breathing devices shall be kept onboard. (SOLAS II-2/13.3.4.1)

2.3.2.7.2 All ships subject to SOLAS Conv. shall carry at least two emergency escape breathing devices within accommodation spaces*. (SOLAS II-2/13.3.4.2)

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**** IMO interpretation***

The minimum number of EEBDs to be kept within accommodation spaces should be as follows:

- *for cargo ships: two (2) EEBDs and one (1) spare EEBD.*
- *for passenger ships – see sec. .11.1.7. (MSC/Circ.1081)*

2.3.3 Means of escape from machinery spaces

2.3.3.1 Escape from machinery spaces of category A

Except as provided in par. 2.3.3.2 (SOLAS par. 13.4.2.4), two means of escape shall be provided from each machinery space of category A. In particular, one of the following provisions shall be complied with:

.1 two sets of steel stairs or ladders[1] as widely separated as possible leading to doors in the upper part of the space similarly separated and from which access is provided to the open deck. One of these stairs or ladders shall be located within a protected enclosure that satisfies sec. 2.2.4, (SOLAS reg. 9.2.3.3) category (4), from the lower part of the space[2] it serves to a safe position[3] outside the space. Self-closing fire doors of the same fire integrity standards shall be fitted in the enclosure. The ladder shall be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The enclosure[4] shall have minimum internal dimensions[5] of at least 800 mm x 800 mm, and shall have emergency lighting provisions; or

.2 one steel stairs or ladder leading to a door in the upper part of the space from which access is provided to the open deck and, additionally, in the lower part of the space and in a position well separated from the stairs or ladder referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the open deck. (SOLAS II-2/13.4.2.1)

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IACS and IMO interpretations

1) *Inclined ladders/stairways in machinery spaces being part of, or providing access to, escape routes, but not located within a protected enclosure shall not have an inclination greater than 60° and shall not be less than 600 mm in clear width. Such requirement need not be applied to ladders/stairways not forming part of an escape route, only provided for access to equipment or components, or similar areas, from one of the main platforms or deck levels within such spaces. (IACS UI SC277, MSC.1/Cir.1511)*

Ladders having strings of flexible steel wire ropes are not acceptable in such escape routes. (MSC/Circ.1120)

2) *Machinery spaces of category A may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space shall be regarded as the lowest deck level, platform or passageway within the space.*

At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors shall be fitted in the protected enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two means of escape. (IACS UI SC277, MSC.1/Cir.1511)

3) *A "safe position" can be any space, excluding cargo spaces, lockers and storerooms irrespective of their area, cargo pump-rooms and spaces where flammable liquids are stowed, but including vehicle and ro-ro spaces, from which access is provided and maintained clear of obstacles to the open deck. (IACS UI SC277, MSC.1/Cir.1511)*

4) *A protected enclosure providing escape from machinery spaces of category A to an open deck may be fitted with a hatch as means of egress from the enclosure to the open deck. The hatch shall have minimum internal dimensions of 800 mm x 800 mm. (IACS UI SC277, MSC.1/Cir.1511)*

5) *Internal dimensions shall be interpreted as clear width, so that a passage having diameter of 800 mm is available throughout the vertical enclosure, as shown in Figure 7 of MSC.1/Circ.1511, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width shall not be less than 600 mm. Figure 7 in MSC.1/Circ.1511 is given as example of some possible arrangements which may be in line with the above interpretation. (IACS UI SC277, MSC.1/Cir.1511)*

2.3.3.2 Dispensation from two means of escape

In a ship of less than 1,000 gross tonnage, may be dispensed with one of the means of escape required under par. 2.3.3.1 (SOLAS par. 13.4.2.1), due regard being paid to the dimension and disposition of the upper part of the space. In addition, the means of escape from machinery spaces of category A need not comply with the requirement for an enclosed fire shelter listed in par. 2.3.3.1.1 (SOLAS par. 13.4.2.1). In the steering gear space, a second means of escape* shall be provided when the emergency steering position is located in that space unless there is direct access to the open deck. (SOLAS II-2/13.4.2.2)

**** IACS interpretation***

Interpretation regarding second means of escape from steering gear spaces:

1. *Steering gear spaces which do not contain the emergency steering position need only have one means of escape.*
2. *Steering gear spaces containing the emergency steering position can have one means of escape provided it leads directly onto the open deck. Otherwise, two means of escape are to be provided but they do not need to lead directly onto the open deck.*
3. *Direct access to the open deck:*

   Escape routes that pass only through stairways and/or corridors are considered as providing a "direct access to the open deck", provided that the escape routes from the steering gear spaces have fire integrity protection equivalent to:
   – *steering gear spaces; or*
   – *stairways/corridors, whichever is more stringent. (IACS UI*

2.3.3.3 Escape from machinery spaces other than those of category A

From machinery spaces other than those of category A, two escape routes shall be provided except that a single escape route may be accepted for spaces that are entered only occasionally, and for spaces where the maximum travel distance* to the door is 5 m or less. (SOLAS II-2/13.4.2.3)

**** IACS and IMO interpretation***

In machinery spaces other than those of category A, which are not entered only occasionally, the travel distance shall be measured from any point normally accessible to the crew, taking into account machinery and equipment within the space. (IACS UI SC277, MSC.1/Cir.1511)

2.3.3.4 Inclined ladders and stairways

All inclined ladders/stairways fitted to comply with par. 2.3.3.1 (SOLAS par. 13.4.2.1) with open treads in machinery spaces being part of or providing access to escape routes but not located within a protected enclosure shall be made of steel. Such ladders/stairways shall be fitted with steel shields attached to their undersides, such as to provide escaping personnel protection against heat and flame from beneath. (SOLAS II-2/13.4.2.4)

2.3.3.5 Escape from machinery control rooms in machinery spaces of category A

Two means of escape shall be provided from the machinery control room* located within a machinery space. At least one of these escape routes shall provide a continuous fire shelter** to a safe position outside the machinery space. (SOLAS II-2/13.4.2.5)

IACS and IMO interpretations

* *A "machinery control room" means a space which serves for control and/or monitoring of machinery used for ship's main propulsion.*

** *A "continuous fire shelter" means a route from a main workshop, or from a machinery control room, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by par. 2.3.3.1.1 (SOLAS reg. 13.4.2.1.1). The boundaries of the continuous fire shelter shall be at least "A-0" class divisions and be protected by self-closing "A -0" class doors. The continuous fire* *shelter shall have minimum internal dimensions of at least 800 mm x 800 mm for vertical trunks and 600 mm in width for horizontal trunks, and shall have emergency lighting provisions. MSC.1/Circ.1511 shows the figures represent typical arrangements of the continuous fire shelters through trunks or through spaces/ rooms to a location outside the machinery space, which should be considered as effective. (IACS UI SC277, MSC.1/Cir.1511)*

2.3.3.6 Escape from main workshops in machinery spaces of category A

Two means of escape shall be provided from the main workshop* within a machinery space. At least one of these escape routes shall provide a continuous fire shelter** to a safe position outside the machinery space. (SOLAS II-2/13.4.2.6)

IACS and IMO interpretations

* *A "main workshop" means a compartment enclosed on at least three sides by bulkheads or gratings, usually containing welding equipment, metal working machinery and workbenches. (MSC.1/Cir.1511) and (IACS UI SC277)*

** *A "continuous fire shelter" means a route from a main workshop, or from a machinery control room, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by par. 2.3.3.1.1 (SOLAS reg. 13.4.2.1.1). The boundaries of the continuous fire shelter shall be at least "A-0" class divisions and be protected by self-closing "A-0" class doors. The continuous fire shelter shall have minimum internal dimensions of at least 800 mm x 800 mm for vertical trunks and 600 mm in width for horizontal trunks, and shall have emergency lighting provisions. MSC.1/Circ.1511 shows the figures represent typical arrangements of the continuous fire shelters through trunks or through spaces/ rooms to a location outside the machinery space, which should be considered as effective. (IACS UI SC277, MSC.1/Cir.1511)*

2.3.3.7 Emergency escape breathing devices (EEBD)

2.3.3.7.1 On all ships subject to SOLAS Conv., within the machinery spaces, emergency escape breathing devices shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of fire. The location of emergency escape breathing devices shall take into account the layout of the machinery space and the number of persons normally working in the spaces*. (SOLAS II-2/13.4.3.1)

**** IMO interpretation***

1 This interpretation applies to machinery spaces where crew are normally employed or may be present on a routine basis.

2 In machinery spaces for category A containing internal combustion machinery used for main propulsion, EEBDs should be positioned as follows:

.1 one (1) EEBD in the engine control room, if located within the machinery space;

.2 one (1) EEBD in workshop areas. If there is, however, a direct access to an escape way from the workshop, an EEBD is not required; and

.3 one (1) EEBD on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).

Alternatively, different number or location may be determined by Administration taking into consideration the layout and dimensions or the normal manning of the space.

3 For machinery spaces of category A other than those containing internal combustion machinery used for main propulsion, one (1) EEBD should, as a minimum, be provided on each deck or platform level near the escape ladder constituting the second means of escape from the space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).

4 For other machinery spaces, the number and location of EEBDs are to be determined by the Administration. (MSC/Circ.1081)

2.3.3.7.2 The number and location of these devices shall be indicated in the *Fire Control Plan* required in sec. 1.3.2 (SOLAS reg. 15.2.4). (SOLAS II-2/13.4.3.2)

2.3.3.7.3 Emergency escape breathing devices shall comply with sub-chapter 5.5 (FSS Code) (SOLAS II-2/13.4.3.3)

2.3.4 Means of escape from ro-ro spaces*

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. (SOLAS II-2/13.6)

***** IMO interpretations**

1 A place where the crew are present to carry out their routine work duties, e.g. during the loading and unloading of a ro-ro deck, or during their ro-ro deck inspections whilst the ship is underway, is considered normally employed.

2 Ro-ro deck inspections could for instance include: fire patrols, inspection of the cargo, check of bilge wells and their alarms, sounding of tanks, cargo deck cleaning, different types of maintenance work (removing of rust, painting, greasing, etc.).

3 Ro-ro spaces should be fitted with at least two means of escape, one located at the fore end and the other at the aft end of the space, from which access is provided to the lifeboat and liferaft embarkation decks. One of the means of escape should be a stairway, the second escape may be a trunk or a stairway

4 The fore and aft ends of the ro-ro space are considered as the areas being within the distance equal to the breadth of the ro-ro space, measured at its widest point, from its forward most and aftmost point.

5 Suitable signs and markings should be provided to indicate the route to the means of escape. (MSC.1/Circ.1505)

The escape (and access) routes should be so arranged to ensure safe escape also during loading and unloading such as indication of escape lane on deck with minimum clearance of 600 mm in width. (MSC/Circ.1120)

CHAPTER 3

3 FIXED FIRE-EXTINGUISHING SYSTEMS

3.1 General requirements

3.1.1 Fire-extinguishing systems shall be so constructed as to be efficient and readily available for operation under all conditions specified in *Part VI*.

3.1.2 Fire-extinguishing medium storage vessels and cylinders used in fire-extinguishing systems shall fulfil the requirements of national/international standards applicable in shipbuilding, as well as applicable requirements for pressure vessels and air receivers, specified in *Part VII*.

3.1.3 Pumps, other than those serving the fire main, required for the provision of water for fire-extinguishing systems required by this *Part V* (chapter), their sources of power and their controls shall be installed outside the space or spaces protected by such systems and shall be so arranged that a fire in the space or spaces protected will not put any such system out of action. (SOLAS II-2/10.4.4)

3.1.4 The use of a fire-extinguishing medium which, in the opinion of the Administration, either by itself or under expected conditions of use gives off toxic gases, liquids and other substances in such quantities as to endanger persons shall not be permitted. (FSS Code, Ch. 1/4)

3.1.5 In fire-extinguishing systems, metal pipes and system components with an appropriate minimum melting point as specified in the requirements for a given system shall be used. Steel pipelines, apart from those made of stainless steel, should be protected against corrosion, and it is recommended to use galvanization on both sides.

3.1.6 Plastic pipes are allowed for the following fire-extinguishing systems:
- water fire main system;
- water-spray system;
- foam system;
- sprinkler system,

used in ship spaces/ areas if they were subjected to fire tests in accordance with sub-chapter 1.7 of *Part VI* (IMO Res. A.753(18), MSC.313(88) and MSC.399(95), and IACS UR P4), having due regard to their location, as specified in sec. 1.7.4, Table 1 of *Part VI*.

3.1.7 Fire-extinguishing systems and inert gas systems pipes shall fulfil the requirements of rules for pipes, specified in sub-chapter 1.5 of *Part VI.*

3.1.8 The pipelines of water-based fire-extinguishing systems permanently filled with water, led outside the ship's spaces or in unheated spaces, shall be so constructed or protected as to prevent freezing in conditions of the occurrence of freezing temperatures.

3.1.9 After installed on board the ship, all the pressure pipelines of fixed fire extinguishing systems, unless otherwise stated, are subject to a hydraulic pressure test at a test pressure of 1.25 working pressure.

3.1.10 Guidelines for periodical inspections and tests of the fixed fire extinguishing systems are given in *Publication 29/I,* included the content of MSC.1/Circ.1318/Rev.1, MSC.1/Circ.1432 and MSC.1/Circ.1516).

3.2 Water fire main system

Ships shall be provided with fire pumps, fire mains, hydrants and hoses complying with the applicable requirements of this sub-chapter 3.2 (regulation). (SOLAS II-2/10.2)

3.2.1 Fire mains and hydrants

3.2.1.1 General

3.2.1.1.1 Materials readily rendered ineffective by heat shall not be used for fire mains and hydrants unless adequately protected. The pipes and hydrants shall be so placed that the fire hoses may be easily coupled to them. The arrangement of pipes and hydrants shall be such as to avoid the possibility of freezing*. Suitable drainage provisions shall be provided for fire main piping. Isolation valves shall be installed for all open deck fire main branches used for purposes other than fire-fighting. In ships where deck cargo may be carried, the positions of the hydrants shall be such that they are always readily accessible and the pipes shall be arranged as far as practicable to avoid risk of damage by such cargo. (SOLAS II-2/10.2.1.1)

*** IMO interpretation**

Special attention should be given to the design of the continuously pressurized pipelines for prevention of freezing in pipes where low temperatures may exist. (MSC/Circ.1120)

3.2.1.1.2 Fire hydrants shall be made of a material resistant to the corrosive effect of sea atmosphere.

3.2.1.1.3 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.

3.2.1.1.4 The water fire main piping running above or in the vicinity of the electrical equipment shall be installed without connections. Where flanged connections are provided which, in the event of leakage of pressurized water, could damage electrical equipment essential to the operation of the ship, they shall be suitably shielded.

3.2.1.1.5 Ready availability of water supply

The arrangements for the ready availability of water supply shall be:

- **.1** in passenger ships – see par. 11.1.13.2;
- **.2** in cargo ships:
  - **.2.1** to the satisfaction of the Administration; and
  - **.2.2** with a periodically unattended machinery space or when only one person is required on watch – see par. 12.5.3.1. (SOLAS II-2/10.2.1.2)

3.2.1.1.6 The arrangements for the ready availability of water supply shall be such that at least one effective jet of water is available from any hydrant and so as to ensure the continuation of the output of water by manually starting of one required fire pump.

3.2.1.1.7 In ships of 500 gross tonnage and upwards, provision shall be made for a remote starting of one of the fire pumps from the from the fire control station located outside the machinery space or from the navigating bridge. In the pump remote starting location, an indicator shall be provided to indicate the pump operation.

3.2.1.1.8 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.

3.2.1.1.9 The location of remote starting of the fire pumps should be indicated with the symbol used on *Fire Control Plan*.

3.2.1.2 Diameter of fire mains

The diameter of the fire main and water service pipes shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously, except that in the case of cargo ships, other than those included in sec. 11.2.3.2 (SOLAS par. 10.7.3.2) (ships designed to carry five or more tiers of containers on or above the weather deck)*, the diameter need only be sufficient for the discharge of 140 m^3/h. (SOLAS II-2/10.2.1.3)

Note:
* See IACS and IMO interpretation (IACS UI SC270, MSC.1/Circ.1550) in para. 11.2.3.2.4

3.2.1.3 Isolating valves and relief valves

3.2.1.3.1 Isolating valves* to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main shall be fitted in an easily accessible and tenable position outside the machinery spaces. 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 fire pump or an emergency fire pump. The emergency fire pump, its seawater inlet, and suction and delivery pipes and isolating valves shall be located outside the machinery space.** If this arrangement cannot be made, the sea-chest may be fitted in the machinery space if the valve is remotely controlled from a position in the same compartment as the emergency fire pump and the suction pipe is as short as practicable. Short lengths of suction or discharge piping may penetrate the machinery space**, provided they are enclosed in a substantial steel casing, or are insulated to "A-60" class standards. The pipes 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. (SOLAS II-2/10.2.1.4.1)

Location of each isolating valve separating the section of the fire main in the machinery space should be indicated with the symbol used on *Fire Control Plan*.

IACS and IMO interpretations

* *Fire pump isolation requirements:*

Any part of the fire main routed through a category A machinery space, except for short lengths of suction or discharge piping, must be fitted with isolating valves outside of the space. The arrangements of the fire mains must allow for fire water from the fire pumps or emergency fire pump to reach all hydrants outside of the isolated space. Isolation requirements of this paragraph are not applicable to the piping from fire pumps located in other spaces other than category A machinery spaces. (IACS UI SC121)

** *Interpretation:*

.1 "the valve" in second sentence means "sea inlet valve";

.2 in cases where suction or discharge piping penetrating machinery spaces are enclosed in a substantial steel casing, or are insulated to "A-60" class standards, it is not necessary to enclose or insulate "distance pieces", "sea inlet valves" and "sea-chests";

.3 the method for insulating pipes to ""A-60" class standards" is that they are to 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; and

.4 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 should 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 standards.

.5 In cases where main fire pumps are provided in compartments outside machinery spaces and where the emergency fire pump suction or discharge piping penetrates such compartments, the above interpretation is to be applied to the piping. (IACS UI SC245/Rev.1, MSC.1/Circ.1456)

3.2.1.3.2 A valve shall be fitted to serve each fire hydrant so that any fire hose may be removed while the fire pumps are in operation. (SOLAS II-2/10.2.1.4.2)

3.2.1.3.3 Relief valves shall be provided in conjunction with fire pumps if the pumps are capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants and hoses. These valves shall be so placed and adjusted as to prevent excessive pressure in any part of the fire main system. (SOLAS II-2/10.2.1.4.3)

3.2.1.4 Number and position of hydrants

3.2.1.4.1 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 (...). Furthermore, such hydrants* shall be positioned near the accesses to the protected spaces. (SOLAS II-2/10.2.1.5.1)

Location of each hydrant should be indicated with the symbol used on *Fire Control Plan.*

*** *IMO interpretation***

At least one hydrant with hose, nozzle and coupling wrench should be provided in machinery spaces of category A. (MSC/Circ.1120)

On cargo ships of gross tonnage less than 500 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.

When calculating the number of hydrants, the length of the water jet should be taken as maximum 7 m.

3.2.1.4.2 On ships of less than 500 gross tonnage the number and position of the hydrants shall be such that at least one jet of water may reach any part of the ship normally accessible to the crew, while the ship is being navigated and any part of any cargo space when empty.

3.2.1.4.3 In addition to the requirements in the par. 3.2.1.4.1 (SOLAS par. 10.2.1.5.1), passenger ships shall comply with requirements of sec. 11.1.13.3. (SOLAS II-2/10.2.1.5.2)

3.2.1.4.4 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.

On ships of gross tonnage less than 500 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.

3.2.1.5 Pressure at hydrants

With the two pumps simultaneously delivering water through the nozzles specified in sec. 3.2.4.3 (SOLAS par. 10.2.3.3), with the quantity of water as specified in par. 3.2.1.2 (SOLAS par. 10.2.1.3), through any adjacent hydrants, the following minimum pressures shall be maintained at all hydrants:

.1 for passenger ships – see par. 11.1.13.4;
.2 for cargo ships:

- 6,000 gross tonnage and upwards – 0.27 N/mm²;
- less than 6,000 but of 500 gross tonnage and upwards –0.25 N/mm²;
- less than 500 gross tonnage but of 150 and upwards – jet of water not less than 12 m horizontally throw length (in domestic service);
- less than 150 gross tonnage – jet of water not less than 6 m horizontally throw length (in domestic service).

.3 the maximum pressure at any hydrant shall not exceed that at which the effective control of a fire hose can be demonstrated. (SOLAS II-2/10.2.1.6)

3.2.1.6 International shore connection

3.2.1.6.1 Standard dimensions

Standard dimensions of flanges for the international shore connection shall be in accordance with the following table: (FSS Code, Ch. 2/2.1)

Table 2.1
Standard dimensions for international shore connections

Description	Dimension
Inside diameter	178 mm
Bolt circle diameter	64 mm
Slots in flange	132 mm
Slots in flange	4 holes 19 mm in diameter spaced equidistantly on a bolt circle of the above diameter, slotted to the flange periphery
Flange thickness	14.5 mm minimum
Bolts and nuts	4, each of 16 mm, 50 mm in length

3.2.1.6.2 Materials and accessories

International shore connections shall be of steel or other equivalent material and shall be designed for 1.0 N/mm² services. The flange shall have a flat face on one side and, on the other side, it shall be permanently attached to a coupling that will fit the ship's hydrant and hose. The connection shall be kept aboard the ship together with a gasket of any material suitable for 1.0 N/mm² services, together with four bolts of 16 mm diameter and 50 mm in length, four 16 mm nuts, and eight washers. (FSS Code, Ch. 2/2.2)

3.2.1.6.3 Arrangement of international shore connection

3.2.1.6.3.1 In ships of 2000 gross tonnage and upwards, 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 par. 3.2.1.6.1, Table 2.1. The shut-off valve is not required if the shore connection is closed with a blind flange fitted with butterfly screws.

3.2.1.6.3.2 Ships of 500 gross tonnage and upwards shall be provided with at least one portable international shore connection complying with par. 3.2.1.6.1, Table 2.1 (FSS Code). (SOLAS II-2/10.2.1.7.1)

3.2.1.6.3.3 Facilities shall be available enabling such a connection to be used on either side of the ship. (SOLAS II-2/10.2.1.7.2)

3.2.1.6.3.4 Portable international shore connection shall be kept in a fire-fighting equipment locker. Location of this shore connection should be indicated with the symbol used on *Fire Control Plan.*

3.2.1.7 Fire hydrants in accommodation area

Hydrants and hose equipment shall be located outside the entrance doors to the accommodation area.

It is recommended, that size of fire hydrants and hoses in accommodation areas in general be not more than 38 mm, due to the possibility of damage in rooms with a large amount of water during extinguishing a fire.

3.2.2 Fire pumps

3.2.2.1 Pumps accepted as fire pumps

Sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil and that if they are subject to occasional duty for the transfer or pumping of oil fuel, suitable change-over arrangements are fitted. (SOLAS II-2/10.2.2.1)

3.2.2.2 Number of fire pumps

Ships shall be provided with independently driven fire pumps as follows:

.1 in passenger ships of – see par. 11.1.13.4;
.2 in cargo ships of:

• 1,000 gross tonnage and upwards	at least two
• less than 1,000 gross tonnage but 500 gross tonnage and upwards	at least two power driven pumps, one of which shall be independently driven. (SOLAS II-2/10.2.2.2)
• less than 500 gross tonnage but 150 and upwards (in domestic service)	at least one independent power driven pump plus power driven pump located in a position outside the space containing the main fire pump
• less than 150 gross tonnage (in domestic service)	at least one power driven pump, which can be driven by the main engine, plus one which can be hand-operated

3.2.2.3 Arrangement of fire pumps and fire mains

3.2.2.3.1 The arrangement of sea connections, fire pumps and their sources of power shall be as to ensure that:

.1 in passenger ships – see par. 11.1.13.6;
.2 in cargo ships of 500 gross tonnage and upwards, if a fire in any one compartment could put all the pumps out of action, there shall be an alternative means consisting of an emergency fire pump* complying with sub-chapter 3.2.2.4 (FSS Code) with its source of power and sea connection located outside the space where the main fire pumps or their sources of power are located. (SOLAS II-2/10.2.2.3.1)

*** *IACS interpretation***

Unless the two main fire pumps, their sea suctions and the fuel supply or source of power for each pump are situated within compartments separated at least by "A-0" divisions, so that a fire in any one compartment will not render both fire pumps inoperable, an emergency fire pump should be fitted.

An arrangement in which one main fire pump is located in 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. (IACS UI SC162)

3.2.2.3.2 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.

3.2.2.3.3 On ships of 500 gross tonnage and upwards, at least one of the fire pumps located in the machinery space shall be supplied from two sea chests.

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

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

3.2.2.3.6 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.

3.2.2.3.7 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.

3.2.2.3.8 Location main fire pumps/ emergency fire pumps should be marked with the symbol used in the *Fire Control Plan.*

3.2.2.4 Fixed emergency fire pump

3.2.2.4.1 General

The emergency fire pump shall be of a fixed independently driven power-operated pump. (FSS Code, Ch. 12/2.1)

3.2.2.4.2 Capacity of the emergency fire pump*

The capacity of the pump shall not be less than 40% of the total capacity of the fire pumps required by par. 3.2.3.1 (SOLAS reg. II-2/10.2.2.4.1) and in any case not less than the follow:

- **.1** for cargo ships of 2,000 gross tonnage and upwards – 25 m^3/h; and
- **.2** for cargo ships less than 2,000 gross tonnage – 15 m^3/h. (FSS Code, Ch. 12/2.2.1.1)

**** IACS and IMO interpretation***

The emergency fire pump shall as a minimum comply with this paragraph.

Where a fixed water-based fire extinguishing system installed for the protection of the machinery space in accordance with sub-chapter 6.2.1.1 (SOLAS reg. II-2/10.4.1.1), is supplied by the emergency fire pump, 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 by that emanating from the biggest nozzle size available onboard from the following table (**note), but shall not be less than 25 m^3/h.*

Capacity of single jet		
Pressure at hydrant	*Nozzle size*	
	16 mm	*19 mm*
0.27 N/mm^2	*16 m^3/h*	*23.5 m^3/h*

***note: When selecting the biggest nozzle size available onboard, the nozzles located in the space where the main fire pumps are located can be excluded. (IACS UI SC163, MSC.1/Circ.1314)*

Note:
Interpretation for cargo ships designed to carry five or more tiers of containers on open deck – see par. 11.2.3.2.4. (IACS UI SC270, MSC.1/Circ.1550)

3.2.2.4.3 Pressure at hydrants

When the emergency fire pump is delivering the quantity of water required by sec. 3.2.2.4.2 (FSS Code, Ch.12/2.2.1.1), the pressure at any hydrants shall be not less than the minimum pressure required by par. 3.2.1.5 (chapter II-2 of the SOLAS Conv.). (FSS Code, Ch. 12/2.2.1.2)

3.2.2.4.4 Suction heads*

The total suction head and the net positive suction head of the emergency fire pump shall be determined having due regard to the requirements of this *Part V* (SOLAS Conv. and FSS Code, chapter 12) on the pump capacity and on the hydrant pressure under all conditions of list, trim, roll and pitch likely to be encountered in service. The ballast condition of a ship on entering or leaving a dry dock need not be considered a service condition. (FSS Code, Ch. 12/2.2.1.3)

**** IACS and IMO interpretations***

1. *It shall be documented that the pump suction head requirements are met and that the suction water inlet is fully submerged under "all conditions of list, trim, roll and pitch likely to be encountered in service", as given in IACS UI SC178 and MSC.1/Circ.1388.*

   (…)
2. *In all cases the net positive suction head (NPSH) available for the pump shall be greater than the NPSH required.*
3. *Upon completion of the emergency fire pump installation, a performance test confirming the required pump capacity required in sub-chapter 3.2.2.4.2 (FSS Code, Ch. 12, par. 2.2.1.1) shall be carried out, and if the emergency fire pump is the main supply of water for any fixed fire-extinguishing system provided to protect the spaces where the main fire pumps are 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 seagoing condition. (IACS UI SC178, MSC.1/Circ.1388)*

Where necessary to ensure priming, the emergency fire pump should be of the self-priming type. (IACS UI SC164)

3.2.2.4.5 Diesel engines and fuel tank

3.2.2.4.5.1 Starting of diesel engine

Any diesel-driven power source for the pump 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, to the satisfaction of the Administration. If hand (manual) starting is impracticable, the Administration may permit compressed air, electricity, or other sources of stored energy, including hydraulic power or starting cartridges to be used as a means of starting. These means shall be such as to enable the diesel-driven power source to be started at least six times within a period of 30 min and at least twice within the first 10 min. (FSS Code, Ch. 12/2.2.2.1)

3.2.2.4.5.2 Fuel tank capacity

Any service fuel tank shall contain sufficient fuel to enable the pump to run on full load for at least three hours 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. (FSS Code, Ch. 12/2.2.2.2)

The minimum level of the required fuel for operation of the emergency fire pump shall be marked on the level indicator of the service fuel tank.

3.2.2.4.6 Location of the space containing the emergency fire pump

The space containing the 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 be insulated to a standard of structural fire protection equivalent to that required for a control station in sub-chapter 2.2.4 (SOLAS reg. 9.2.3.3). (SOLAS II-2/10.2.2.3.2.1)

The space where the pump and prime mover are installed should have adequate place for maintenance work and inspections. (IACS REC. 135)

*** IACS interpretation**

Emergency fire pump access:

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 pump. (IACS UI SC114)

3.2.2.4.7 Access to the space containing the emergency fire pump

No direct access shall be permitted between the machinery space and the space containing the emergency fire pump and its source of power. When this is impracticable, the Administration may accept 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 at least steel, both reasonably gastight, self-closing and without any hold back arrangements. Alternatively, the access may be through a watertight door capable of being operated from a space remote from the machinery space and the space containing the emergency fire pump and unlikely to be cut off in the event of fire in those spaces. In such cases, a second means of access to the space containing the emergency fire pump and its source of power shall be provided. (SOLAS II-2/10.2.2.3.2.2)

3.2.2.4.8 Ventilation of the emergency fire pump space

The space 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.

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 a machinery space fire entering or being drawn into that space. (SOLAS II-2/10.2.2.3.2.3)

3.2.2.4.9 Electric emergency fire pump

The emergency fire pump may be powered by an electric motor supplied from an emergency source of power*.

*** IMO interpretation**

The electrical cables to the emergency fire pump are not to pass through the machinery spaces containing the main fire pumps and their source(s) of power and prime mover(s). Otherwise *they are to be of a fire resistant type, in accordance with IACS Unified Requirement E 15 Electrical Services Required to be Operable Under Fire Conditions and Fire Resistant Cables, paragraph 1, where they pass through other high fire risk areas. (MSC/Circ.1120 – interpr. to SOLAS Reg. II-2/10.2.2.3.2.2)*

3.2.2.5 Additional pumps for cargo ships*

In addition, in cargo ships where other pumps, such as general service, bilge and ballast, etc., are fitted in a machinery space, arrangements shall be made to ensure that at least one of these pumps, having the capacity and pressure required by par. 3.2.1.5 and 3.2.3.2 (SOLAS par. 10.2.1.6.2 and 10.2.2.4.2), is capable of providing water to the fire main. (SOLAS II-2/10.2.2.3.3)

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* ***IACS and IMO interpretation***

This paragraph does not force designers to choose pumps with capacity and pressure characteristics other than that being optimal for the service intended, just to make their connection to the fire main possible, provided the required number and capacity of fire pumps are already fitted. (IACS UI SC97, MSC/Circ.1120)

3.2.3 Capacity of fire pumps

3.2.3.1 Total capacity of required fire pumps

The required fire pumps shall be capable of delivering for fire-fighting purposes a quantity of water, at the pressure specified in par. 3.2.1.5 (SOLAS par 10.2.1.6), as follows:

.1 pumps in passenger ships – see par.11.1.13.7;

.2 pumps in cargo ships* of 500 gross tonnage and upwards, other than any emergency pump, the quantity of water is not less than four thirds of the quantity required under SOLAS, reg. II-1/35-1 to be dealt with by each of the independent bilge pumps in a passenger ship of the same dimension when employed in bilge pumping, provided that in no cargo ship, other than those included in sub-chapter 11.2.3.2 (SOLAS par. 10.7.3.2) – cargo ships design to carry more than five tiers of containers on or above the weather deck, need the total required capacity of the fire pumps exceed 180 m^3/h; (SOLAS II-2/10.2.2.4.1)

Note:
* Interpretation – see par. 11.2.3.2.4. (IACS UI SC270, MSC.1/Circ.1550)

.3 pump on ships of less than 500 gross tonnage but 150 and upwards –capacity of main fire pump shall be capable of delivering at least two (2) required jets of water;

.4 pump on ships of less than 150 gross tonnage–capacity of main fire pump shall be capable of delivering at least one (1) required jets of water

3.2.3.2 Capacity of each fire pump

Each of the required fire pumps (other than any emergency pump required in par. 3.2.2.3.1.2 (SOLAS par. 10.2.2.3.1.2)) for cargo ships of 500 gross tonnage and upwards) shall have a capacity not less than 80% of the total required capacity divided by the minimum number of required fire pumps but in any case not less than 25 m^3/h and each such pump shall in any event be capable of delivering at least the two required jets of water. These fire pumps shall be capable of supplying the fire main system under the required conditions. Where more pumps than the minimum of required pumps are installed such additional pumps shall have a capacity of at least 25 m^3/h and shall be capable of delivering at least the two jets of water required in par. 3.2.1.4.1 (SOLAS par. 10.2.1.5.1). (SOLAS II-2/10.2.2.4.2)

3.2.4 Fire hoses and nozzles

3.2.4.1 General specifications

3.2.4.1.1 Fire hoses shall be of non-perishable material approved by the Administration 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 hose shall be provided with a nozzle and the necessary couplings*. Hoses specified in this *Part V* (chapter) as "fire hoses" shall, together with any necessary fittings and tools, be kept ready for use in conspicuous positions near the water service hydrants or connections. 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 other spaces and open decks; and
.3 25 m for open decks on ships with a maximum breadth in excess of 30 m. (SOLAS II-2/10.2.3.1.1)

In ships of less than 500 gross tonnage, the length of fire hose shall not exceed:

.4 10 m in machinery spaces;
.5 15 m in superstructure spaces and on open decks.

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

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* ***IACS interpretation***

Aluminum alloys may be used for fire hose couplings and nozzles, except in open deck areas of oil tankers and chemical tankers. (IACS UI SC146)

3.2.4.1.2 Unless one hose and nozzle is provided for each hydrant in the ship, there shall be complete interchangeability of hose couplings and nozzles. (SOLAS II-2/10.2.3.1.2)

3.2.4.1.3 Fire hoses shall comply with EN 694 standard. They are subject to tests in accordance with PN-EN 14540 + A1 standard.

3.2.4.1.4 Fire hoses with nozzles and any necessary fittings and tools shall be placed in hose boxes, located in conspicuous positions near the hydrants.

Fire hoses boxes should be marked with the symbol used on *Fire Control Plan.*

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

3.2.4.2 Number and diameter of fire hoses

3.2.4.2.1 Ships shall be provided with fire hoses the number and diameter of which shall be to the satisfaction of the Administration. (SOLAS II-2/10.2.3.2.1)

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

3.2.4.2.2 In passenger ships – see par. 11.1.13.10.

3.2.4.2.3 In cargo ships:

.1 of 1,000 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 any hoses required in any engine or boiler room. The Administration may increase the number of hoses required so as to ensure that hoses in sufficient number are available and accessible at all times, having regard to the type of ship and the nature of trade in which the ship is employed. Ships carrying dangerous goods in accordance with chapter 7 (SOLAS reg. 19) shall be provided with 3 hoses and nozzles, in addition to those required above; and
.2 of less than 1,000 gross tonnage, the number of fire hoses to be provided shall be calculated in accordance with the provisions of sub-par. .1 above.

However, the number of hoses shall in no case be less than three (3). (SOLAS II-2/10.2.3.2.3)

3.2.4.3 Size and types of fire hose nozzles

3.2.4.3.1 For the purposes of this *Part V* (chapter), standard nozzle sizes shall be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Administration. (SOLAS II-2/10.2.3.3.1)

Where other fire-extinguishing systems are used – such as fog fire-extinguishing systems – smaller diameter nozzles may be permitted.

3.2.4.3.2 For accommodation and service spaces, a nozzle size greater than 12 mm need not be used. (SOLAS II-2/10.2.3.3.2)

3.2.4.3.3 For machinery spaces and exterior locations, the nozzle size shall be such as to obtain the maximum discharge possible from two jets at the pressure mentioned in par. 3.2.1.5 (SOLAS par. 10.2.1.6) from the smallest pump, provided that a nozzle size greater than 19 mm need not be used. (SOLAS II-2/10.2.3.3.3)

3.2.4.3.4 Nozzles* shall be of an approved dual-purpose type (i.e., spray/jet type) incorporating a shutoff. (SOLAS II-2/10.2.3.3.4)

Fire hose nozzles shall be made of a material resistant to the corrosive effect of sea water.

***** ***IACS interpretation***

Fire hose nozzles made of plastic type material, e.g. polycarbonate, are considered acceptable provided capacity and serviceability are documented and the nozzles are found suitable for the marine environment. (IACS UI SC98)

3.2.5 Tests of the system after installation on board

3.2.5.1 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.2.5.2 After installation on board, the system is subject to functional tests of fire pumps, operation of isolating valves, hydrants and fire hoses, in accordance with the agreed acceptance and test program.

3.3 Automatic sprinkler, fire detection and fire alarm systems

3.3.1 Application

This sub-chapter 3.3 details the specifications for automatic sprinkler, fire detection and fire alarm systems as required by this *Part V* (chapter II-2 of the SOLAS Conv.). (FSS Code, Ch. 8/1)

3.3.2 General

3.3.2.1 Type of sprinkler systems

The automatic sprinkler systems shall be of the wet pipe type, but small exposed sections may be of the dry pipe type* where in the opinion of the Administration this is a necessary precaution**. Control stations, where water may cause damage to essential equipment, may be fitted with a dry pipe system or a pre-action system as permitted by par. 11.1.8.2.1 (SOLAS reg. II-2/10.6.1.1). Saunas shall be fitted with a dry pipe system, with sprinkler heads having an operating temperature up to 140°C. (FSS Code, Ch. 8/2.1.1)

IACS and IMO interpretations

* *Definition of "dry pipe system": A sprinkler system employing automatic sprinklers attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a sprinkler) permits the water*

pressure to open a valve known as a dry pipe valve. The water then flows into the piping system and out of the opened sprinklers. (Res. A.800(19), annex, paragraph 2.3) (MSC/Cir.1120)

** *Heat detectors are acceptable in refrigerated chambers and in other spaces where steam and fumes are produced such as saunas and laundries. Refrigerated chambers may be fitted with dry pipe sprinkler systems. (IACS UI SC130)*

3.3.2.2 Sprinkler systems equivalent

Automatic sprinkler systems equivalent to those specified in sec. 3.3.1 to 3.3.6 (FSS Code, Ch. 8/par. 2.2 to 2.4) – see sec. 3.3.7. (FSS Code, Ch. 8/2.1.2)

3.3.3 Sources of power supply

3.3.3.1 Passenger ships

See par. 11.1.8.1.1 (FSS Code, Ch. 8/2.2.1)

3.3.3.2 Cargo ships

There shall not be less than two sources of power supply for the sea water pump and automatic alarm and detection system. If the pump is electrically driven it shall be connected to the main source of electrical power, which shall be capable of being supplied by at least two generators. The feeders shall be so arranged as to avoid galleys, machinery spaces and other enclosed spaces of high fire risk except in so far as it is necessary to reach the appropriate switchboards. One of the sources of power supply for the alarm and detection system shall be an emergency source. Where one of the sources of power for the pump is an internal combustion engine it shall, in addition to complying with the provisions of sub-chapter 3.3.5.3 (FSS Code, par. 2.4.3), be so situated that a fire in any protected space will not affect the air supply to the machinery. (FSS Code, Ch. 8/2.2.2)

3.3.4 Component requirements

3.3.4.1 Sprinklers

3.3.4.1.1 The sprinklers shall be resistant to corrosion by marine atmosphere. In accommodation and service spaces the sprinklers shall come into operation within the temperature range from 68 degrees C to 79 degrees C, except that in locations such as drying rooms, where high ambient temperatures might be expected, the operating temperature may be increased by not more than 30 degrees C above the maximum deckhead temperature. (FSS Code, Ch. 8/2.3.1.1)

3.3.4.1.2 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 IMO Res. A.800(19), as amended by Res. MSC.265 (84).

3.3.4.1.3 A quantity of spare sprinkler heads shall be provided for all types and ratings installed on the ship as follows:

Total number of heads	Required number of spares
< 300	6
300 ÷ 1000	12
> 1000	24

The number of spare sprinkler heads of any type need not exceed the total number of heads installed of that type. (FSS Code, Ch. 8/2.3.1.2)

3.3.4.2 Pressure tanks*

3.3.4.2.1 A pressure tank having a volume equal to at least twice that of the charge of water specified in this paragraph shall be provided. The tank shall contain a standing charge of fresh water, equivalent to the amount of water which would be discharged in one minute by the pump referred to in par. 3.3.4.3.2 (FSS Code, par. 2.3.3.2), and the arrangements shall provide for maintaining an air pressure in the tank such as to ensure that where the standing charge of fresh water in the tank has been used the pressure will be not less than the working pressure of the sprinkler, plus the pressure exerted by a head of water measured from the bottom of the tank to the highest sprinkler in the system. Suitable means of replenishing the air under pressure and of replenishing the fresh water charge in the tank shall be provided. A glass gauge shall be provided to indicate the correct level of the water in the tank. (FSS Code, Ch. 8/2.3.2.1)

Note:
* For sizing of the pressure tank, see interpretations given in par. 3.3.4.3.3. (MSC.1/Circ.1556)

3.3.4.2.2 Means shall be provided to prevent the passage of sea water into the tank. (FSS Code, Ch. 8/2.3.2.2)

3.3.4.2.3 The pressure tank shall fulfil the requirements for pressure vessels, set out in chapter 12 of *Part VII.*

3.3.4.3 Sprinkler pumps*

3.3.4.3.1 An independent power pump shall be provided solely for the purpose of continuing automatically the discharge of water from the sprinklers. The pump shall be brought into action automatically by the pressure drop in the system before the standing fresh water charge in the pressure tank is completely exhausted. (FSS Code, Ch. 8/2.3.3.1)

3.3.4.3.2 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^2 at the application rate specified in par. 3.3.6.2.3 (FSS Code, par. 2.5.2.3). The hydraulic capability of the system shall be confirmed by the review of hydraulic calculations, followed by a test of the system, if deemed necessary by the Administration. (FSS Code, Ch. 8/2.3.3.2)

3.3.4.3.3 The pump shall have fitted on the delivery side a test valve with a short open-ended discharge pipe. The effective area through the valve and pipe shall be adequate to permit the release of the required pump output while maintaining the pressure in the system specified in par. 3.3.4.2.1 (FSS Code, par. 2.3.2.1). (FSS Code, Ch. 8/2.3.3.3)

**** IMO interpretations***

For sizing the sprinkler pumps and pressure tank, the calculation method should be as follows:

.1 for sprinkler systems in accordance with this sub-chapter *3.3 (chapter 8 of the FSS Code), the pump capacity and pressure tank volume should be calculated by multiplying the 5 l/m^2/min application rate times the area of 280 m^2;*

.2 for equivalent sprinkler systems – see sec. 3.3.7.3;

.3 for application to a ship with the largest area separated from adjacent spaces by A-class divisions of less than 280 m^2, the area required when sizing pumps and alternate supply components is the largest given area; and

.4 for application to a ship with a total protected area of less than 280 m^2 the Administration may specify the appropriate area for sizing of pumps and alternate supply components. (MSC.1/Circ.1556)

3.3.5 Installation requirements

3.3.5.1 General

3.3.5.1.1 Any parts of the system which may be subjected to freezing temperatures in service shall be suitably protected against freezing. (FSS Code, Ch. 8/2.4.1.1)

3.3.5.1.2 Special attention shall be paid to the specification of water quality provided by the system manufacturer to prevent internal corrosion of sprinklers and clogging or blockage arising from products of corrosion or scale-forming minerals. (FSS Code, Ch. 8/2.4.1.2)

3.3.5.1.3 Spaces/group of spaces covered by the automatic sprinkler system should be marked by a plate, placed at entrance door, with the section number served and symbol used on *Fire Control Plan*.

3.3.5.2 Piping arrangements

3.3.5.2.1 Sprinklers shall be grouped into separate sections, each of which shall contain not more than 200 sprinklers. In passenger ships – see par. 11.1.8.1.2. (FSS Code, Ch. 8/2.4.2.1)

3.3.5.2.2 Each section of sprinklers shall be capable of being isolated by one stop valve only. The stop valve in each section shall be readily accessible in a location outside of the associated section or in cabinets within stairway enclosures. The valve's location shall be clearly and permanently indicated with the symbol used on *Fire Control Plan.* Means shall be provided to prevent the operation of the stop valves by any unauthorized person. (FSS Code, Ch. 8/2.4.2.2)

On each stop (section) valve, clear marking plate indicating the section number served should be provided.

3.3.5.2.3 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 for that section. (FSS Code, Ch. 8/2.4.2.3)

3.3.5.2.4 The sprinkler system shall have a connection from the ship's fire main by way of a lockable screw-down non-return valve at the connection which will prevent a backflow from the sprinkler system to the fire main. (FSS Code, Ch. 8/2.4.2.4)

3.3.5.2.5 A gauge indicating the pressure in the system shall be provided at each section stop valve and at a central station. (FSS Code, Ch. 8/2.4.2.5)

3.3.5.2.6 The sea inlet to the pump shall wherever possible 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. (FSS Code, Ch. 8/2.4.2.6)

3.3.5.2.7 The suction pipe of sprinkler pump shall be fitted with filter to prevent the sprinklers against getting clogged.

3.3.5.2.8 Provision shall be made in each section of sprinkler for blowing the pipes with compressed air and flushing them with fresh water.

3.3.5.3 Location of system components

The sprinkler pump and tank shall be situated in a position reasonably remote from any machinery space of category A and shall not be situated in any space required to be protected by the sprinkler system. (FSS Code, Ch. 8/2.4.3)

The room containing sprinkler pump and the pressure tank should be indicated by a plate, placed on the entrance door, with the symbol used on *Fire Control Plan*.

3.3.6 System control requirements

3.3.6.1 Ready availability

3.3.6.1.1 Any required automatic sprinkler, fire detection and fire alarm system shall be capable of immediate operation at all times and no action by the crew shall be necessary to set it in operation. (FSS Code, Ch. 8/2.5.1.1)

3.3.6.1.2 The automatic sprinkler system shall be kept charged at the necessary pressure and shall have provision for a continuous supply of water as required in this sub-chapter 3.3. (FSS Code, Ch. 8/2.5.1.2)

3.3.6.2 Alarm and indication

3.3.6.2.1 Each section of sprinklers shall include means for giving a visual and audible alarm signal automatically at one or more indicating units whenever any sprinkler comes into operation. Such alarm systems shall be such as to indicate if any fault occurs in the system. Such units shall indicate in which section served by the system a fire has occurred and shall be centralized on the navigating bridge or in the continuously manned central control station and, in addition, visible and audible alarms from the unit shall also be placed in a position other than on the aforementioned spaces to ensure that the indication of fire is immediately received by the crew. (FSS Code, Ch. 8/2.5.2.1)

3.3.6.2.2 Switches shall be provided at one of the indicating positions referred to in par. 3.3.6.2.1 (FSS Code, par. 2.5.2.1) which will enable the alarm and the indicators for each section of sprinklers to be tested. (FSS Code, Ch. 8/2.5.2.2)

3.3.6.2.3 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 $l/m^2/min$ over the nominal area covered by the sprinklers. For this purpose, nominal area* shall be taken as the gross horizontal projection of the area to be covered. However, the Administration may permit the use of sprinklers providing such an alternative amount of water suitably distributed as has been shown to the satisfaction of the Administration to be not less effective. (FSS Code, Ch. 8/2.5.2.3)

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* ***IMO interpretation***

Nominal area is defined as being the gross, horizontal projection of the area to be covered. (MSC/Circ.1120)

3.3.6.2.4 A list or plan shall be displayed at each indicating unit showing the spaces covered and the location of the zone in respect of each section. Suitable instructions for testing and maintenance shall be available. (FSS Code, Ch. 8/2.5.2.4)

3.3.6.3 Testing

3.3.6.3.1 Means shall be provided for testing the automatic operation of the pump on reduction of pressure in the system. (FSS Code, Ch. 8/2.5.3)

3.3.6.3.2 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.3.6.3.3 After installation on board, the system is subject to functional testing in operation of sprinkler pump, pressure tank, section valves, alarms and indication, based on agreed test program.

3.3.7 Equivalent high-pressure sprinkler systems (water mist)

3.3.7.1 General

3.3.7.1.1 Below guidelines are based on IMO Res. A.800(19), as amended by MSC.265(84) and MSC.284(86). PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.3.7.1.2 Equivalent sprinkler systems must have the same characteristics which have been identified as significant to the performance and reliability of automatic sprinkler systems approved under the requirements of sec. 3.3.2 to 3.3.6 (SOLAS reg. II-2/12). (Res. A.800, An.1)

3.3.7.1.3 Automatic sprinkler systems equivalent to those specified in sec. 3.3.2 to 3.3.6. (FSS Code, Ch. 8, par. 2.2 to 2.4 shall be approved by the Administration based on the guidelines developed by Organization* (FSS Code, Ch. 5/2.4)

** Refer to the Revised Guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS regulation II-2/12 as adopted by IMO by resolution A.800(19), as amended by MSC.265(84) and MSC.284(86).*

3.3.7.2 Definitions

For the purposes of this section 3.3.7, the following definitions apply:

.1 ***Antifreeze system***: A wet pipe sprinkler system employing automatic sprinklers attached to a piping system containing an antifreeze solution and connected to a water supply. The antifreeze solution is discharged, followed by water, immediately upon operation of sprinklers opened by heat from a fire. (Res. A.800, An.2.1)

.2 ***Deluge system***: A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto. (Res. A.800, An.2.2)

.3 ***Dry pipe system***: A sprinkler system employing automatic sprinklers attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a sprinkler) permits the water pressure to open a valve known as a dry pipe valve. The water then flows into the piping system and out of the opened sprinklers. (Res. A.800, An.2.3)

.4 ***Preaction system***: A sprinkler system employing automatic sprinklers attached to a piping system containing air that may or may not be under pressure, with a supplemental detection system installed in the same area as the sprinklers. Actuation of the detection system opens a valve that permits water to flow into the sprinkler piping system and to be discharged from any sprinklers that may be open. (Res. A.800, An.2.4)

.5 ***Water-based extinguishing medium***: Fresh water or sea water with or without additives mixed to enhance fire-extinguishing capability. (Res. A.800, An.2.5)

.6 ***Wet pipe system***: A sprinkler system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by heat from a fire. (Res. A.800, An.2.6)

3.3.7.3 Principal requirements for the system

3.3.7.3.1 The system should be automatic in operation, with no human action necessary to set it in operation. (Res. A.800, An.3.1)

3.3.7.3.2 The system should be capable of both detecting the fire and acting to control or suppress the fire with a water-based extinguishing medium. (Res. A.800, An.3.2)

3.3.7.3.3 The sprinkler system should be capable of continuously supplying the water-based extinguishing medium for a minimum of 30 min. A pressure tank* or other means should be provided to meet the functional requirement stipulated in par. 3.3.4.2.1 (the FSS Code, ch. 8, par. 2.3.2.1). The design of the system should ensure that full system pressure is available at the most remote nozzle in each section within 60 s of system activation. (Res. MSC.265, An.3.3)

*** *IMO interpretation***
For sizing the sprinkler pumps and pressure tank, the calculation method should be as follows:

.1 for sprinkler systems in accordance with sub-chapters 3.3.2 to 3.3.6 (chapter 8 of the FSS Code), the pump capacity and pressure tank volume should be calculated by multiplying the 5 l/m²/min application rate times the area of 280 m²;

.2 for equivalent sprinkler systems, the pump capacity and pressure tank volume, or other means meeting the functional requirements stipulated in par. 3.3.4.2 (2.3.2.1 of chapter 8 of the FSS Code) should be calculated by multiplying the highest application rate of the most hydraulically demanding area at the minimum design pressure, as determined by full scale fire testing according to the Revised guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS reg. II-2/12 (resolution A.800(19)), as amended by resolution MSC.265(84), times the area of 280 m². In cases where multiple types of spaces are located within the hydraulically most demanding 280 m² area, the application rate of each respective area should be applied;

.3 for application to a ship with the largest area separated from adjacent spaces by A-class divisions of less than 280 m², the area required when sizing pumps and alternate supply components is the largest given area; and

.4 for application to a ship with a total protected area of less than 280 m² the Administration may specify the appropriate area for sizing of pumps and alternate supply components. (MSC.1/Circ.1556)

3.3.7.3.4 The system should be of the wet pipe type but small exposed sections may be of the dry pipe, pre-action, deluge, antifreeze or other type to the satisfaction of the Administration where this is necessary. (Res. A.800, An.3.4)

3.3.7.3.5 The system should be capable of fire control or suppression under a wide variety of fire loading, fuel arrangement, room geometry and ventilation conditions. (Res. A.800, An.3.5)

3.3.7.3.6 The system and equipment should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered in ships. (Res. A.800, An.3.6)

3.3.7.3.7 The system and its components should be designed and installed in accordance with international standards acceptable to the Organization*, and manufactured and tested to the satisfaction of the Administration in accordance with the requirements given in appendices 1 and 2 to guidelines in Res. A.800, as amended by Res. MSC.265. (Res. A.800, An.3.7)

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* Pending the development of international standards acceptable to the Organization, national standards as prescribed by the Administration should be applied.

3.3.7.3.8 There should be not less than two sources of power for the system. Where the sources of power for the pump are electrical, these should be a main generator and an emergency source of power. One supply for the pump should be taken from the main switchboard, and one from the emergency switchboard by separate feeders reserved solely for that purpose. The feeders should be so arranged as to avoid galleys, machinery spaces and other enclosed spaces of high fire risk except in so far as it is necessary to reach the appropriate switchboards, and should be run to an automatic changeover switch situated near the sprinkler pump. This switch should permit the supply of power from the main switchboard so long as a supply is available there from, and be so designed that upon failure of that supply it will automatically change over to the supply from the emergency switchboard. The switches on the main switchboard and the emergency switchboard should be clearly labelled and normally kept closed. No other switch should be permitted in the feeders concerned. One of the sources of power supply for the system should be an emergency source. Where one of the sources of power for the pump is an internal combustion engine, it should, in addition to complying with the provisions of sec. 3.3.5.3 (the FSS Code, ch. 8, par. 2.4.3), be so situated that a fire in any protected space will not affect the air supply to the machinery. Pump sets consisting of two diesel engines each supplying at least 50% of the required water capacity are considered acceptable if the fuel supply is adequate to operate the pumps at full capacity for a period of 36 h on passenger ships and 18 h on cargo ships. (Res. MSC.265, An.3.8)

3.3.7.3.9 The system should be provided with a redundant means of pumping, including drivers, or otherwise supplying a water-based extinguishing medium to the sprinkler system. The capacity of the redundant means should be sufficient to compensate for the loss of any single supply pump or alternative source.

Failure of any one component in the power and control system should not result in a reduction of the automatic release capability or reduction of sprinkler pump capacity by more than 50%. Hydraulic calculations should be conducted to assure that sufficient flow and pressure are delivered to the hydraulically most remote 140 m^2 in the event of the failure of any one component. (Res. MSC.265, An.3.9)

3.3.7.3.10 The system should be fitted with a permanent sea inlet and be capable of continuous operation using seawater. (Res. A.800, An.3.10)

3.3.7.3.11 The piping system should be sized in accordance with an hydraulic calculation technique.* (Res. A.800, An.3.11)

* Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	C
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

3.3.7.3.12 Sprinklers should be grouped into separate sections. Any section should not serve more than two decks of one main vertical zone. (Res. A.800, An.3.12)

3.3.7.3.13 Each section of sprinklers should be capable of being isolated by one stop valve only. The stop-valve in each section should be readily accessible in a location outside of the associated section or in cabinets within stairway enclosures. The valve's location should be clearly and permanently indicated with the symbol used on *Fire Control Plan*. Means should be provided to prevent the operation of the stop-valves by an unauthorized person. Isolation valves used for service, maintenance or for refilling of antifreeze solutions may be installed in the sprinkler piping in addition to the section stop valves, if provided with a means for giving a visual and audible alarm as required by par. 3.3.7.3.17 (Res. A.800, An. 3.17). Valves on the pump unit may be accepted without such alarms if they are locked in the correct position. (Res. MSC.265, An.3.13)

3.3.7.3.14 Sprinkler piping should not be used for any other purpose. (Res. A.800, An.3.14)

3.3.7.3.15 The sprinkler system water supply components should be outside category A machinery spaces and should not be situated in any space required to be protected by the sprinkler system. (Res. MSC.265, An.3.15)

3.3.7.3.16 A means for testing the automatic operation of the system for assuring the required pressure and flow should be provided. (Res. A.800, An.3.16)

3.3.7.3.17 Each sprinkler section should be provided with a means for giving a visual and audible alarm at a continuously manned central control station within one minute of flow from one or more sprinklers, a check valve, pressure gauge, and a test connection with a means of drainage. (Res. A.800, An.3.17)

3.3.7.3.18 A sprinkler control plan should be displayed at each centrally manned control station. (Res. A.800, An.3.18)

3.3.7.3.19 Installation plans and operating manuals should be supplied to the ship and be readily available on board. A list or plan should be displayed showing the spaces covered and the location of the zone in respect of each section. Instructions for testing and maintenance should also be available on board. The maintenance instructions should include provisions for a flow test of each section at least annually to check for possible clogging or deterioration in the discharge piping. (Res. MSC.265, An.3.19)

3.3.7.3.20 Sprinklers should have fast response characteristics as defined in ISO standard 6182-1. (Res. A.800, An.3.20)

3.3.7.3.21 In accommodation and service spaces the sprinklers should have a nominal temperature rating of 57°C to 79°C, except that in locations such as drying rooms, where high ambient temperatures might be expected, the nominal temperature may be increased by not more than 30ºC above the maximum deckhead temperature. (Res. A.800, An.3.21)

3.3.7.3.22 Pumps and alternative supply components should be capable of supplying the required flow rate and pressure for the space with the greatest hydraulic demand. For the purposes of this calculation, the design area used to calculate the required flow and pressure should be the deck area of the most hydraulically demanding space, separated from adjacent spaces by A-class divisions. The design area need not exceed 280 m^2. For application to a small ship with a total protected area of less than 280 m^2, the Administration may specify the appropriate area for sizing of pumps and alternate supply components. (Res. MSC.265, An.3.22)

3.3.7.3.23 The nozzle location, type of nozzle, and nozzle characteristics should be within the tested limits determined by the fire test procedures in appendix 2 of res. A.800(19) as amended by res. MSC.265(84) to provide fire control or suppression as referred to in par. 3.3.8.3.2. (Res. MSC.265, An.3.23)

3.3.7.3.24 For atriums with intermediate level deck openings exceeding 100 m^2, ceiling mounted sprinklers are not required. (Res. MSC.265, An.3.24)

3.3.7.3.25 The system should be designed in such a way that during a fire occurrence, the level of protection provided to those spaces unaffected by fire is not reduced. (Res. MSC.265, An.3.25)

3.3.7.3.26 A quantity of spare water mist nozzles should be carried for all types and ratings installed on the ship as follows:

Total number of nozzles	Required number of spares
< 300	6
300 ÷ 1000	12
> 1000	24

The number of spare nozzles of any type need not exceed the total number of nozzles installed of that type. (Res. MSC.265, An.3.26)

3.3.7.3.27 Any parts of the system which may be subjected to freezing temperatures in service should be suitably protected against freezing. (Res. MSC.265, An.3.27)

3.3.7.3.28 The suction pipe of sprinkler pump shall be fitted with appropriate filter to prevent the sprinklers against getting clogged.

3.3.7.4 Tests of the system after installation on board

3.3.7.4.1 For pre-action systems, means shall be provided for testing the automatic staring of the pump after activation of fire detectors.

3.3.7.4.2 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.3.7.4.3 After fitting on board, the system is subject to functional testing in operation of pump, pressure tank, section valves, alarms and indication, based on agreed test program.

3.4 Fixed-pressure water-spraying fire-extinguishing systems

3.4.1 General

3.4.1.1 The water-spraying system is to consist of a supply water pump, water distribution pipelines that can be divided into sections, with shut-off (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 protected space. For protection of ship spaces, where the system capacity is less than 50% of the water main fire pumps capacity, specified in par. 3.2.3.1, 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 The water pressure shall be sufficient to secure an even distribution of water in the protected space.

3.4.1.4 The spraying nozzles shall be arranged so as to secure an effective distribution of water in the spaces which are to be protected.

3.4.1.5 The system shall be provided with appropriate filters protecting the nozzles against clogging by impurities in the sea water or by splashes of rust from the pipeline.

3.4.1.6 Pipelines shall be provided with drainage.

3.4.1.7 In each of the protected spaces, water shall be drained overboard by gravity or by means of a bilge system.

3.4.2 Fixed water-based fire-fighting systems for ro-ro spaces and special category spaces

3.4.2.1 General

3.4.2.1.1 Below guidelines are based on MSC.1/Cir.1430/Rev.3. PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.4.2.1.2 The system is intended for use in open and closed ro-ro spaces and special category spaces defined in par. 1.2.12, 1.2.13, 1.2.35, 1.2.36, 1.2.46 and 1.2.49 (SOLAS reg. II-2/3.12, II-2/3.13, II-2/3.35, II-2/3.36, II-2/3.46 and II-2/3.49). (MSC.1/Circ.1430/Rev.3, An. par.1.1)

3.4.2.1.3 Deluge systems can be applied on open ro-ro spaces when the actual wind condition is taken into consideration, for example through the use of high velocity nozzles. (An. par.1.1)

3.4.2.1.4 Systems using automatic sprinklers or nozzles are only permitted for closed ro-ro and special category spaces or other spaces where wind conditions are not likely to affect system performance. (An. par.1.1)

3.4.2.1.5 All systems should comply with sec. 3.4.2.3 (An. par.1, 2 and 3). In addition, prescriptive-based systems should comply with section 3.4.3.4, and performance-based systems should comply with section 3.4.3.5. (An. par.1.2)

3.4.2.1.6 Fixed water-based fire-fighting systems for ro-ro spaces, vehicle spaces and special category spaces shall be approved by the Administration based on guidelines developed by the Organization*. (FSS Code, Ch. 7/2.4)

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* Refer to the *Revised guidelines for approval of fixed water-based fire-fighting systems for ro-ro spaces and special category spaces* (MSC.1/Circ.1430/Rev.3).

3.4.2.2 Definitions

For the purposes of this section 3.4.2, the following definitions apply:

.1 ***Area of operation*** is a design area for wet-pipe, automatic sprinkler system (to be determined for performance-based systems by the test procedure described in the appendix to MSC.1/Circ.1430/Rev.3). (An. par.2.1)

.2 ***Automatic sprinkler or nozzle*** is a single or multiple orifice water discharge device that activates automatically when its heat-activated element is heated to its thermal rating or above, allowing water under pressure to discharge in a specific, directional discharge pattern.

.3 ***Automatic system*** is a system utilizing either automatic sprinklers or nozzles or a system that is automatically activated by a fire detection system.

.4 ***Deluge system, automatic and manual release*** is a system employing open nozzles attached to a piping system connected to a water supply through a valve that can be opened by signals from a fire detection system and by manual operation. When this valve is opened, water flows into the piping system and discharges from all nozzles attached thereto.

.5 ***Deluge system, manual release*** is a system employing open nozzles attached to a piping system connected to a water supply through a valve that is opened by manual operation. When this valve is opened, water flows into the piping system and discharges from all nozzles attached thereto.

.6 ***Dry pipe system*** is a system employing automatic sprinklers or nozzles attached to a piping system containing air or nitrogen under pressure, the release of which (as from the activation of a sprinkler or nozzle by heat from a fire) permits the water pressure to open a valve known as a dry pipe valve. The water then flows into the piping and discharges from the open nozzles or sprinklers.

.7 ***Fire control*** limits the size of a fire by distribution of water so as to decrease the heat release rate, while controlling ceiling gas temperatures and pre-wetting adjacent combustibles and/or reducing heat radiation to avoid structural damage.

.8 ***Fire suppression*** is the sharp reduction of the heat release rate of a fire and the prevention of regrowth.

.9 ***K-factor*** is a sprinkler nozzle discharge coefficient determined by testing, that is used to calculate flow rate at any given pressure through the relationship $Q = k\ P^{1/2}$, where Q is the flow rate in litres per minute, and P is the pressure in bars.

.10 ***Open sprinkler or nozzle*** is an open single or multiple orifice water discharge device that, when discharging water under pressure, will distribute the water in a specific, directional discharge pattern.

.11 ***Performance based requirements*** are based on the results of fire tests conducted on specific nozzle design and arrangements. The required engineering parameters for such systems are determined by the results of the fire tests.

.12 ***Prescriptive based requirements*** are specific requirements, such as minimum water discharge density or maximum nozzle spacing, and are applied equally to all systems designed to this approach.

.13 ***Pump*** means a single water pump, with its associated driver and control or an individual pump within a pump unit.

.14 ***Pump unit*** means a single water pump, or two or more pumps connected together to form a unit, with their associated driver(s) and controls.

.15 ***Pre-action system*** is a system employing automatic sprinklers or nozzles attached to a piping system containing air that may or may not be under pressure, with a supplemental fire detection system installed in the same area as the sprinklers or nozzles. Activation of the fire detection system opens a valve that permits water to flow into the system piping and to be discharged from any sprinkler or nozzle that has operated.

.16 ***Water-based extinguishing medium*** is fresh water or seawater, with or without an antifreeze solution and/or additives to enhance fire-extinguishing capability.

.17 ***Water discharge density*** is the unit rate of water application to an area or surface expressed in mm/min (equal to (l/min)/m²).

.18 ***Wet pipe system*** is a system employing automatic sprinklers or nozzles attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers or nozzles opened by heat from a fire.

.19 ***Height of the protected space*** is the distance between the lower deck plate and upper deck plate within a protected space. (An. par.2)

3.4.2.3 Principal requirements for all systems

3.4.2.3.1 The system may be automatically activated, automatically activated with provisions for manual activation or manually activated. (An. par.3.1)

3.4.2.3.2 All systems should be divided into sections. Each section should be capable of being isolated by one section control valve. The section control valves should be located outside the protected space, in separated release station which should be readily accessible without entering the protected spaces and their location should be clearly and permanently indicated. (An. par.3.2)

Direct access to the release station with section control valves from the vehicle deck space should be provided. (Res. A.123(V)(d))

On each section valve, clear marking plate indicating the spaces/ section number served should be provided.

Within the protected space, section number should be marked on both sides of the space/ central spaces walls, using same designation number for section control valve as the one used at the release station. Letters and numbers should be min. 300 mm in height and be in a clearly visible and contrasting colour.

In the release station, principal diagram of the protected area should be provided for each section valve.

A pressure gauge should be provided on the section valves manifold.

Location of the release station should be indicated by a plate at entrance door with the symbol used on *Fire Control Plan*.

3.4.2.3.2.1 It should be possible to manually open and close the section control valves either directly on the valve or via a control system routed outside of the protected spaces. Means should be provided to prevent the operation of the section control valves by an unauthorized person. Control valve locations should be adequately ventilated to minimize the build-up of smoke. (An. par.3.2.1)

3.4.2.3.2.2 A continuously manned control station and release station(s) for deluge systems should have remote indication of pump running and pressure in valve manifold. For deluge systems, release stations with controls for start and stop of pump(s) and operation (opening and closing) of section control valves should be provided in the valve room and in a continuously manned control station or the safety centre, if fitted. Remote indication of position of valves (open/closed) should be provided in the continuously manned control station or the safety centre, if fitted. (An. par.3.2.2)

3.4.2.3.3 The piping system should be sized in accordance with a hydraulic calculation technique* such as the Hazen-Williams hydraulic calculation technique or the Darcy-Weisbach hydraulic calculation technique, to ensure the availability of the flows and pressures required for correct performance of the system. The design of the system should ensure that full system pressure is available at the most remote sprinkler or nozzle in each section within 60 s of activation. (An. par.3.3)

* Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	C
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

3.4.2.3.4 The system supply equipment should be located outside the protected spaces and all power supply components (including cables) should be installed outside of the protected space.

The electrical components of the pressure source for the system should have a minimum rating of IP 54. (An. par.3.4)

3.4.2.3.5 Activation of an automatic system should start operation of all nozzles in the section and should give a visual and audible alarm at a continuously manned station. The alarm in the continuously manned station should indicate the specific section of the system that is activated. The system alarm requirements described within this paragraph are in addition to, and not a substitute for, the detection and fire alarm system required by sec. 11.3.1.3 (SOLAS reg. II-2/20.4). (An. par.3.5)

3.4.2.3.6 Wet pipe systems on board vessels that can operate in areas where temperatures below 0°C can be expected, should be protected from freezing either by having temperature control of the space, heating coils on pipes, antifreeze agents or other equivalent measures. (An. par.3.6)

3.4.2.3.7 The capacity of the system water supply should be sufficient for the total simultaneous coverage of the minimum coverage area of tables 4-1 to 4-3 and 5-1 and the vertically applicable area as defined in par. 3.4.2.3.22 (An. par.3.22). (An. par.3.7)

3.4.2.3.8 The system should be provided with a redundant means of pumping or otherwise supplying a water-based extinguishing medium to the system. The capacity of the redundant means should be sufficient to compensate for the loss of any single supply pump or alternative source. Failure of any one component in the power and control system should not result in a reduction of required pump capacity of deluge systems. In the case of wet pipe, dry pipe and pre-action systems, failure of any one component in the power and control system should not result in a reduction of the automatic release capability or reduction of required pump capacity by more than 50%. However, systems requiring an external power source need only be supplied by the main power source. Hydraulic calculations should be conducted to assure that sufficient flow and pressure are delivered to the hydraulically most demanding section both in normal operation and in the event of the failure of any one component. (An. par.3.8)

Additionally, the system should be supplied from water fire main system (using emergency power supply for fire pump) connected to the system by a lockable non-return valve. (Res. A.123(V)(e))

3.4.2.3.9 The system should be fitted with a permanent sea inlet and be capable of continuous operation during a fire using sea water. (An. par.3.9)

3.4.2.3.10 The system and its components should be designed to withstand ambient temperatures, vibration, humidity, shock, impact, clogging and corrosion normally encountered. Piping, pipe fittings and related components except gaskets inside the protected spaces should be designed to withstand 925°C. Distribution piping should be constructed of galvanized steel, stainless steel, or equivalent. Sprinklers and nozzles should comply with par. 3.4.2.3.11 (An. par.3.11). (An. par.3.10)

3.4.2.3.11 The system and its components should be designed and installed based on international standards acceptable to the Organization*. The nozzles should be manufactured and tested based on the relevant sections of appendix A to circular MSC/Circ.1165 (*Revised Guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump-rooms*). (An. par.3.11)

* Pending the development of international standards acceptable to the Organization, national standards as prescribed by the Administration should be applied.

3.4.2.3.12 A means for testing the automatic operation of the system and, in addition, assuring the required pressure and flow should be provided. (An. par.3.12)

3.4.2.3.13 If the system is pre-primed with water containing a fire suppression enhancing additive and/or an antifreeze agent, periodic inspection and testing, as specified by the manufacturer, should be undertaken to ensure that their effectiveness is being maintained. Fire suppression enhancing additives should be approved for fire protection service by an independent authority. The approval should consider possible adverse health effects to exposed personnel, including inhalation toxicity. (An. par.3.13)

3.4.2.3.14 Operating instructions for the system should be displayed at each operating position. (An. par.3.14)

3.4.2.3.15 Installation plans and operating manuals should be supplied to the ship and be readily available on board. A list or plan should be displayed showing spaces covered and the location of the zone in respect of each section. Instructions for testing and maintenance should be available on board. (An. par.3.15)

3.4.2.3.16 Spare parts should be provided as recommended by the manufacturer. In the case of automatic sprinkler systems, the total number of spare sprinkler heads for each type of sprinklers shall be six for the first 300, 12 for the first 1,000. (An. par.3.16)

3.4.2.3.17 Where automatic systems are installed, a warning notice should be displayed outside each entry point stating the type of medium used (i.e. water) and the possibility of automatic release. (An. par.3.17)

3.4.2.3.18 All installation, operation and maintenance instruction/plans for the system should be in the working language of the ship. If the working language of the ship is not English, French or Spanish, a translation into one of these languages should be included. (An. par.3.18)

3.4.2.3.19 Any foam concentrates used as system additives should comply with the *Revised guidelines for the performance and testing criteria and surveys of foam concentrates for fixed fire-extinguishing systems* (MSC.1/Circ.1312/Corr.1). (An. par.3.19)

3.4.2.3.20 Means for flushing of systems with fresh water should be provided. (An. par.3.20)

3.4.2.3.21 The presence of obstructions and the potential for shielding of the water spray should be evaluated to ensure that the system performance is not affected. Supplementary sprinklers or nozzles should be installed beneath obstructions. In addition, nozzles should be located to protect spaces above and below intermediate decks, hoistable decks and ramps. Nozzles below hoistable decks should be capable of protecting all applicable heights. (An. par.3.21)

3.4.2.3.22 Vertically the applicable area of all decks, including hoistable decks or other intermediate decks, between reasonably gas-tight steel decks (or equivalent materials), should be included for simultaneous coverage (example: with one hoistable deck, both the layer above and below this deck with a dimensioning area complying with tables 4-1 to 4-3 or 5-1 should be included in the water supply calculations). Decks with ramps are accepted as reasonably gas-tight decks assuming that the ramps are always in their closed position at sea and the ramps and the decks which these ramps are part of are reasonably gas-tight. (An. par.3.22)

3.4.2.3.23 The length of a deluge section (along the lanes) should not be less than 20 m and the width of the section should not be less than 14 m. Further, the sections need not be longer or wider than the distance between reasonably gas-tight steel bulkheads (or equivalent materials). The maximum size of a section on any single deck should be 48 m multiplied by the width of cargo space (measured as distance between tight steel divisions). Vertically one section can cover up to three decks. (An. par.3.23)

3.4.2.4 Additional prescriptive-based system design requirements

In addition to the requirements in sec. 3.4.2.3 (An. sec. 3), systems designed with this approach should comply with par. 3.4.2.4.1 to 3.4.2.4.10 (An. par. 4.1 to 4.10).

3.4.2.4.1 Wet pipe, dry pipe and pre-action systems should be designed for simultaneous coverage of the hydraulically most demanding area at the minimum water discharge density given in tables 4-1 to 4-3. The minimum operating pressure of any sprinkler should be 0.05 MPa. (An. par.4.1)

3.4.2.4.2 Deluge systems should be designed for the simultaneous activation of the two adjacent deluge sections with the greatest hydraulic demand at the minimum water discharge density given in tables 4-1 to 4-3. The minimum operating pressure of any sprinkler should be 0.12 MPa. (An. par. 4.2)

Table 4-1
Minimum required water discharge density and area of coverage for decks having a height equal to or less than 2.5 m

Type of system	Minimum required water discharge density (mm/min)	Minimum coverage area
Wet pipe system	6.5	280 m^2
Dry pipe or pre-action system	6.5	280 m^2
Deluge system	5	2 x 20 m x *B*

Table 4-2
Minimum required water discharge density and area of coverage for decks having a height in excess of 2.5 m but equal to or less than 6.5 m

Type of system	Minimum required water discharge density (mm/min)	Minimum coverage area
Wet pipe system	15	280 m^2
Dry pipe or pre-action system	15	365 m^2
Deluge system	10	2 x 20 m x *B*[*)]

Table 4-3
Minimum required water discharge density and area of coverage for decks having a height in excess of 6.5 m but less than 10.0 m

Type of system	Minimum required water discharge density (mm/min)	Minimum coverage area
Wet pipe system	20	280 m^2
Dry pipe or pre-action system	20	365 m^2
Deluge system	15	2 x 20 m x *B* [*)]

* *B* – full breadth of the protected space [m].

3.4.2.4.3 Automatic sprinklers or nozzles intended for decks with a height equal to or less than 2.5 m should have a nominal operating temperature range between 57°C and 79°C and standard response characteristics. If required by ambient conditions, higher temperature ratings may be acceptable. (An. par.4.3)

3.4.2.4.4 Automatic sprinklers or nozzles intended for decks with a height in excess of 2.5 m and hoistable decks that can be raised above 2.5 m should have a nominal operating temperature range between 121°C and 149°C and standard response characteristics. (An. par.4.4)

3.4.2.4.5 Sprinklers or nozzles should be positioned in such a way that:

.1 they are not exposed to damage by cargo;
.2 undisturbed spray is ensured; and
.3 water is distributed over and between all vehicles or cargo in the area being protected.

Automatic sprinklers or nozzles should be positioned and located so as to provide satisfactory performance with respect to both activation time and water distribution. (An. par.4.5)

3.4.2.4.6 Only upright sprinklers or nozzles are allowed for dry pipe or pre-action systems. (An. par.4.6)

3.4.2.4.7 For wet pipe and dry pipe sprinkler systems, fire detection systems should be installed in accordance with the requirements of sec.11.3.1.3 (SOLAS reg. II-2/20.4). (An. par.4.7)

3.4.2.4.8 For manual deluge systems, automatic deluge systems and pre-action systems, fire detection systems should be provided complying with the requirements of sub-chapter 4.1 (FSS Code) and the following additional requirements:

.1 the detection system should consist of flame, smoke or heat detectors of approved types, arranged as described below. The flame detectors should be installed under fixed continuous decks according to the limitation and application defined by the maker and the approval certificate. The smoke and heat detector arrangement shall comply with the sub-chapter 4.1 (FSS Code). Smoke detectors with a spacing not exceeding 11 m or heat detectors with a spacing not exceeding 9 m should be installed under hoistable ramps;
.2 the detection system should ensure rapid operation while consideration should also be given to preventing accidental release. The area of coverage of the detection system sections should correspond to the area of coverage of the extinguishing system sections. The following arrangements are acceptable:
  .1 set-up of approved flame detectors and approved smoke detectors or heat detectors; or
  .2 set-up of approved smoke detectors and approved heat detectors; other arrangements can be accepted by the Administration;
  .3 for automatic deluge systems and pre-action systems, the discharge of water should be controlled by the detection system. The detection system should provide an alarm upon activation of any single detector and discharge if two or more detectors activate. The Administration may accept other arrangements; and
  .4 automatically released systems should also be capable of manual operation (both opening and closing) of the section valves. Means should be provided to prevent the simultaneous release of multiple sections that result in water-flow demand in excess of the pumping system design capacity. The automatic release may be disconnected during on- and off-loading operations, provided that this function is automatically reconnected after a pre-set time being appropriate for the operations in question. (An. par.4.8)

3.4.2.4.9 Where beams project more than 100 mm below the deck, the spacing of spot-type heat detectors at right angles to the direction of the beam travel should not be more than two thirds of the spacing permitted under sub-chapter 4.1 (chapter 9 of the FSS Code). (An. par.4.9)

3.4.2.4.10 Where beams project more than 460 mm below the deck and are more than 2.4 m on centre, detectors should be installed in each bay formed by the beams. (An. par.4.10)

3.4.2.5 Additional performance-based system design requirements

In addition to the requirements in section 3.4.2.3, systems designed with this approach should comply with par.3.4.2.5.1 to 3.4.2.5.6 (An. par.5.1 to 5.6).

3.4.2.5.1 The system should be capable of fire suppression and control and be tested to the satisfaction of the Administration in accordance with the appendix to MSC.1/Circ.1430/Rev.3. (An. par.5.1)

3.4.2.5.2 The nozzle location, type of nozzle and nozzle characteristics should be within the limits tested to provide fire suppression and control as referred to in par. 3.4.2.5.1 (An. par.5.1). (An. par.5.2)

3.4.2.5.3 System designs should be limited to the use of the maximum and minimum temperature ratings of the thermally sensitive fire detection devices tested to provide fire suppression and control as referred to in par. 3.4.2.5.1 (An. par.5.1). (An. par.5.3)

3.4.2.5.4 The capacity of the system water supply should be sufficient for the total simultaneous coverage of the minimum coverage area of table 5-1 and the vertically applicable area as defined in par. 3.4.2.3.22 (An. par 3.22), and the requirements of par. 3.4.2.5.5 (An par.5.5). (An. par.5.4)

Table 5.1
Minimum coverage area per type of system

Type of system (Definition number)		Minimum coverage area
A	Wet pipe, automatic sprinkler heads (3.4.2.2.18)	280 m² or area of operation as defined in the fire tests – whichever is larger
B	Deluge system, automatic[1] and manual release (3.4.2.2.4)	280 m² and the overlapping or adjacent section as defined by par. 3.1.5.5[2]
C	Deluge system, manual release (3.4.2.2.5)	2 sections each of min 20 m x *B*[2), 3)]
D	Other systems (3.4.2.2.6 and 3.4.2.2.15)	Equivalent to the above systems and to the satisfaction of PRS

Notes:

1) The automatic release should comply with the requirements of par. 3.1.5.6.
2) The pump should be sized to cover the largest section for type B systems and the two largest horizontally adjacent sections for type C systems.
3) *B* – full breadth of the protected space.

3.4.2.5.5 The section arrangement for a deluge system with automatic and manual release (system B) should be such that a fire in any location of the border zone between two or more sections would be completely surrounded by activated spray heads, either by activating more than one section or by overlapping sections (whereby two or more sections cover the same area in the vicinity of the border between sections). In case of overlapping sections, such overlap should be a minimum of two times the required spray head spacing of the section in question or five metres, whichever is larger. These overlapping sections need not comply with the minimum width and length requirements of par. 3.4.2.3.23 (An. par.3.23). (An. par.5.5)

3.4.2.5.6 For systems of type B (see table 5-1) an efficient fire detection and fire confirmation system covering all parts of the ro-ro or special category spaces should be provided as follows:

.1 the fire detection system shall consist of flame detectors and smoke detectors of approved types. The flame detectors shall be installed under fixed continuous decks according to the limitation and application defined by the maker and the approval certificate. The smoke detector arrangement shall comply with sub-chapter 4.1 (FSS Code). Additional smoke detectors with a spacing not exceeding 11 m shall be installed under hoistable ramps;

.2 a colour TV monitoring system should cover all parts of the ro-ro or special category spaces. Cameras need not be installed below hoistable decks if the camera arrangement can identify smoke (confirm fire) based on positions under a fixed continuous deck. The monitors for the colour TV monitoring system should be located in the continuously manned control station having the controls for section control valves and start/stop control of pumps addressed under par. 3.4.2.3.2.2 (An. par.3.2.2); and

.3 the relevant section of the deluge system should be automatically released when two detectors covering this area activate. Systems being released when only one detector activates may also be accepted. Automatically released systems should also be capable of manual operation (both opening and closing) of the section valves. The automatic release may be disconnected during on- and off-loading operations, provided that this function is automatically reconnected after a preset time being appropriate for the operations in question. (An. par.5.6)

3.4.2.6 Piping

3.4.2.6.1 All piping and couplings shall be protected internally and externally against corrosion for all parts between sea inlet and the spray heads.

3.4.2.6.2 The system should be provided with connection to a fresh water tank for testing and flushing. This shall have capacity to test any one section for 5 minutes at the required flow of water.

3.4.2.6.3 An air connection and drain valve(s) shall be provided ensuring that all parts of the piping system can be drained and blown through with air after testing. All parts of the piping system shall be self-draining to drain valves or open nozzles.

3.4.2.7 Tests of the system after installation on board

3.4.2.7.1 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.4.2.7.2 After installation on board, the system is subject to functional tests in accordance with the agreed acceptance and test program.

3.4.3 Fixed-pressure water-spraying fire-extinguishing systems for machinery spaces and cargo pump-rooms

3.4.3.1 General

3.4.3.1.1 Below guidelines are based on MSC/Circ.1165, as amended. PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.4.3.1.2 Fixed-pressure water-spraying fire-extinguishing systems for machinery spaces and cargo pump-rooms shall be approved by the Administration based on the guidelines developed by the Organization*.

* Refer to the *Revised Guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump-rooms* - MSC/Circ.1165, as amended.

3.4.3.2 Definitions

For the purposes of this section 3.4.3, the following definitions apply:

.1 ***Antifreeze system*** is a wet pipe system containing an antifreeze solution and connected to a water supply. The antifreeze solution is discharged, followed by water, immediately upon operation of nozzles. (An. par.2)

.2 ***Bilge area*** is the space between the engine-room floor plates (perforated or non-perforated) or gratings and the bottom of the engine-room. (MSC/Circ.1165, An. par.3 and MSC.1/Circ.1458)

.3 ***Deluge system*** is a system employing open nozzles attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the nozzles or opened manually. When this valve opens, water flows into the piping system and discharges from all nozzles attached thereto. (An. par.4)

.4 ***Dry pipe system*** is a system employing nozzles attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a nozzle) permits the water pressure to open a valve known as a dry pipe valve. The water then flows into the piping system and out of the opened nozzle. (An. par.5)

.5 ***Fire extinction*** is a reduction of the heat release from the fire and a total elimination of all flames and glowing parts by means of direct and sufficient application of extinguishing media. (An. par.6)

.6 ***Pre-action system*** is a system employing automatic nozzles attached to a piping system containing air that may or may not be under pressure, with a supplemental detection system installed in the same area as the nozzles. Actuation of the detection system opens a valve that permits water to flow into the piping system and to be discharged from any nozzles that may be open. (An. par.7)

.7 ***Water-based extinguishing medium*** is fresh water or seawater with or without additives mixed to enhance fire-extinguishing capability. (An. par.8)

.8 ***Wet pipe system*** is a system employing nozzles attached to a piping system containing water and connected to a water supply so that water discharges immediately from the nozzles upon system activation. (An. par.9)

3.4.3.3 Principal requirements for the system

3.4.3.3.1 The system should be capable of manual release. (An. par.10)

3.4.3.3.2 The system should be capable of fire extinction, and tested to the satisfaction of the Administration in accordance with appendix B to MSC/Circ.1165, as amended by MSC.1/Circ.1237, MSC.1/Circ.1269 and MSC.1/1386, including annex to MSC.1/Circ.1385. Additionally, IACS UI SC218, Rev.1 and SC219, Rev.1 should be considered during type testing. (An. par.11)

3.4.3.3.3 The system should be available for immediate use and capable of continuously supplying water for at least 30 min in order to prevent re-ignition or fire spread within that period of time. Systems which operate at a reduced discharge rate after the initial extinguishing period should have a second full fire-extinguishing capability available within a 5-minute period of initial activation. (An. par.12)

3.4.3.3.4 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered in machinery spaces or cargo pump-rooms in ships. Components within the protected spaces should be designed to withstand the elevated temperatures which could occur during a fire. (An. par.13)

3.4.3.3.5 The system and its components should be designed and installed in accordance with international standards acceptable to the Organization* and manufactured and tested to the satisfaction of the Administration in accordance with appropriate elements of appendices A and B to MSC/Circ.1165, as amended. (An. par.14)

* Pending the development of international standards acceptable to IMO, national standards as prescribed by the Administration should be applied.

3.4.3.3.6 The nozzle location, type of nozzle and nozzle characteristics should be within the limits tested to provide fire extinction as referred to in par. 3.4.3.3.2 (An. par.11). (MSC/Circ.1165, An.15)

3.4.3.3.7 The electrical components of the pressure source for the system should have a minimum rating of IP 54. The system should be supplied by both main and emergency sources of power and should be provided with an automatic change-over switch. The emergency power supply should be provided from outside the protected machinery space. (MSC/Circ.1165, An.16)

3.4.3.3.8 The system should be provided with a redundant means of pumping. The capacity of the redundant means should be sufficient to compensate for the loss of any single supply pump. Failure of any one component in the power and control system should not result in a reduction of required pump capacity. Primary pump starting equipment may be manual or automatic. Switch over to redundant means of pumping may be manual or automatic. The system should be fitted with a permanent sea inlet and be capable of continuous operation using seawater. (MSC/Circ.1165, An. par.17 and MSC.1/Circ.1386)

3.4.3.3.9 The piping system should be sized in accordance with an hydraulic calculation technique.* (An. par.18)

* Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	C
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

3.4.3.3.10 Systems capable of supplying water at the full discharge rate for 30 min may be grouped into separate sections within a protected space. The sectioning of the system within such spaces should be approved by the Administration in each case. (An. par.19)

The location of section valves manifold should be marked with the symbol used on *Fire Control Plan*.

On each section valve, clear marking plate indicating the section number/ part of machinery space served should be provided

3.4.3.3.11 In all cases the capacity and design of the system should be based on the complete protection of the space demanding the greatest volume of water. (An. par.20)

3.4.3.3.12 The system operation controls should be available at easily accessible positions outside the spaces to be protected and should not be liable to be cut off by a fire in the protected spaces. (An. par.21)

3.4.3.3.13 Pressure source components of the system should be located outside the protected spaces. (An. par.22)

3.4.3.3.14 A means for testing the operation of the system for assuring the required pressure and flow should be provided. (An. par.23)

3.4.3.3.15 Activation of any water distribution valve should give a visual and audible alarm in the protected space and at a continuously manned central control station. An alarm in the central control station should indicate the specific valve activated. (An. par.24)

3.4.3.3.16 Operating instructions for the system should be displayed at each operating position. The operating instructions should be in the official language of the flag State. If the language is neither English nor French, a translation into one of these languages should be included. (An. par.25)

3.4.3.3.17 Spare parts and operating and maintenance instructions for the system should be provided, as recommended by the manufacturer. (An. par.26)

3.4.3.3.18 Additives should not be used for the protection of normally occupied spaces unless they have been approved for fire protection service by an independent authority. The approval should consider possible adverse health effects to exposed personnel, including inhalation toxicity. (An. par.27)

3.4.3.3.19 Nozzles should be arranged within the entire area of the machinery compartment including casing, pump room and bilge area. (MSC/Circ.1386)

3.4.3.4 Tests of the system after installation on board

3.4.3.4.1 For pre-action systems, means shall be provided for testing the automatic staring of the pump after activation of fire detectors.

3.4.3.4.2 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.4.3.4.3 After installation on board, the system is subject to functional tests in operation of pump, alarms and indication, based on agreed acceptance and test program.

3.4.4 Fixed water-based local application fire-fighting system for machinery spaces of category A

3.4.4.1 General

3.4.4.1.1 Below guidelines are based on MSC.1/Cir.1387/Corr.1, as amended. PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.4.4.1.2 Fixed water-based local application fire-fighting systems should provide localized fire suppression in areas, as specified in sec. 6.2.7 (SOLAS reg. II-2/10.5), for category A machinery spaces, without the necessity of engine shut-down, personnel evacuation, shutting down of forced ventilation fans, or sealing of the space. (MSC.1/Circ.1387/Corr.1, An. par.1)

3.4.4.1.3 Fixed water-based local application fire-fighting systems for machinery spaces of category A shall be approved by the Administration based on the guidelines developed by the IMO*.

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* Refer to *Revised Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces* - MSC.1/Circ.1387/Corr.1, as amended.

**** IACS interpretation***

Any installation of nozzles on board should reflect the arrangement successfully tested in accordance with MSC.1/Circ.1387/Corr.1. If a specific arrangement of the nozzles is foreseen on board, deviating from the one tested as per MSC.1/Circ.1387, it can be accepted provided such arrangement additionally passes fire tests based on the scenarios of this circular. (IACS UI SC176/Rev.1)

3.4.4.2 Definitions

For the purposes of this section 3.4.4, the following definitions apply:

.1 ***Fire suppression*** is a reduction in heat output from the fire and control of the fire to restrict its spread from its seat and reduce the flame area. (An. par.2.1)

.2 ***Protected space*** is a machinery space where a local application fire-fighting system (hereinafter, referred to as "the system") is installed. (An. par.2.2)

.3 ***Protected area*** is an area* (an installation or part of an installation) within a protected space which is required to be protected by the system. (An. par.2.3)

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* For internal combustion machinery, typical protected areas are hot surfaces such as exhaust pipes without insulation, or with insulation fitted in accordance with SOLAS reg. II-2/4.2.2.6.1 (surfaces with a temperature > 220°C) that is likely to be removed frequently for maintenance, and high-pressure fuel oil systems installed near hot surfaces. For typical diesel engines, such areas would include the area on top of the engine, the fuel injection pumps and turbo chargers, unless the fuel injection pumps are installed in a sheltered location beneath the steel platform.

For boiler fronts and oil-fired inert gas generators, typical protected areas are hot surfaces around the burners without insulation, or with insulation fitted in accordance with SOLAS reg. II-2/4.2.2.6.1 (surfaces with a temperature > 220°C) that is likely to be removed frequently for maintenance. Boiler fronts should be interpreted as the boiler burner location irrespective of the boiler design.

For incinerators, typical protected areas are hot surfaces around the burners without insulation, or with insulation fitted in accordance with SOLAS reg. II-2/4.2.2.6.1 (surfaces with a temperature > 220°C) that is likely to be removed frequently for maintenance.

.4 ***Water-based extinguishing medium*** is freshwater or seawater with or without additives mixed to enhance fire-extinguishing capability. (An. par.2.4)

3.4.4.3 Principal requirements for the system

3.4.4.3.1 System operation

.1 The system should be capable of manual release. (MSC.1/Circ.1387/Corr.1, An. par.3.1.1)

.2 The activation of the system should not require engine shutdown, closing fuel oil tank outlet valves, evacuation of personnel or sealing of the space, which could lead to loss of electrical power or reduction of maneuverability. This is not intended to place requirements on the electrical equipment in the protected area when the system is discharging freshwater. (MSC.1/Circ.1387, An. par. 3.1.2)

The system should ensure fire suppression during operation of fans supplying air to the protected space or a solution should be provided for automatic shutdown of the fans after activation of the system.

.3 The operation controls should be located at easily accessible positions inside and outside the protected space. The controls inside the space should not be liable to be cut off by a fire in the protected areas. (MSC.1/Circ.1387, An. par. 3.1.3)

The system control panel should be located in the engine control room. Buttons for activating individual sections of the system should be located in the vicinity of each protected area.

The location of the operation controls should be marked with the symbol used on *Fire Control Plan.*

.4 Pressure source components of the system should be located outside the protected areas. (MSC.1/Circ.1387, An. par. 3.1.4)

.5 Where automatically operated fire-fighting systems are installed:

.1 a warning notice should be displayed outside each entry point stating the type of medium used and the possibility of automatic release; (MSC.1/Circ.1387, An. par. 3.1.5.1)

.2 the detection system should ensure rapid operation while consideration should also be given to preventing accidental release. The area of coverage of the detection system sections should correspond to the area of coverage of the extinguishing system sections. The following arrangements are acceptable:

.1 set-up of two approved flame detectors; or

.2 set-up of one approved flame detector and one approved smoke detector.

Other arrangements can be accepted by the Administration. However, use of heat detectors should in general be avoided for these systems; (MSC.1/Circ.1387, An. par. 3.1.5.2, IACS UI SC176/Rev.1)

.3 the discharge of water should be controlled by the detection system. The detection system should provide an alarm upon activation of any single detector and discharge if two or more detectors activate. The Administration may accept other arrangements; and (MSC.1/Circ.1387, An. par. 3.1.5.3)

.4 grouped visual and audible alarms, as well as indication of the activated section should be provided in each protected space, in the engine control room and the navigation bridge or continuously manned central control station. Audible alarms may use a single tone. (MSC.1/Circ.1387, An. par. 3.1.5.4, IACS UI SC176, Rev.1)

.6 Operating instructions for the system should be displayed at each operating position. (MSC.1/Circ.1387, An. par. 3.1.6)

.7 Appropriate operational measures or interlocks should be provided if the engine-room is fitted with a fixed high-expansion foam or aerosol fire-fighting system, to prevent the local application system from interfering with the effectiveness of these systems. (MSC.1/Circ.1387, An. par. 3.1.7)

3.4.4.3.2 Arrangement of nozzles and water supply

.1 The system should be capable of fire suppression based on testing conducted in accordance with the appendix to MSC.1/Circ.1387 (these Guidelines). Any installation of nozzles on board should reflect the arrangement successfully tested in accordance with the appendix to MSC.1/Circ.1387 (these Guidelines). If a specific arrangement of the nozzles is foreseen on board, deviating from the one tested, it can be accepted provided such arrangement additionally passes fire tests based on the scenarios of the appendix to MSC.1/Circ.1387 (these Guidelines). (MSC.1/Circ.1387, An. par. 3.2.1, IACS UI SC176/Rev.1)

.2 The location, type and characteristics of the nozzles* should be within the limits tested in accordance with the appendix to MSC.1/Circ.1387 (these Guidelines). Nozzle positioning should take into account obstructions to the spray of the fire-fighting system. The use of a single row of nozzles or single nozzles may be accepted for installation where this gives adequate protection according to par. 3.4.2.4 of the appendix to MSC.1/Circ.1387. (MSC.1/Circ.1387, An. par. 3.2.2)

* Spray head arrangement should be according to conditions specified in the Society's type approval certificate, Additionally, fuel oil installations attached to the engines should also be protected.

Turbo chargers also should be adequately protected.

Discharge of water directly into electric generators and engine air intakes shall be avoided.

.3 The piping system should be sized in accordance with a hydraulic calculation technique such as the Hazen-Williams hydraulic calculation technique* and the Darcy-Weisbach hydraulic calculation technique, to ensure availability of flows and pressures required for correct performance of the system. (MSC.1/Circ.1387, An. par. 3.2.3)

* Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	C
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

.4 The system may be grouped into separate sections within a protected space. The capacity and design of the system should be based on the section demanding the greatest volume of water. In any case the minimum capacity should be adequate for a single section protecting the largest single engine, diesel generator or piece of machinery. In multi-engine installations, at least two sections should be arranged*. (MSC.1/Circ.1387, An. par. 3.2.4)

Each section of piping should be separated by a section valve – solenoid/ pneumatic, controlled remotely from the control panel and from the point of starting of each section. Solenoid/ pneumatic valves should be capable of being opened manually in the event of a power failure. The supply water pump and section valves should be located outside the protected areas.

On each section valve, clear marking plate indicating the section number served should be provided.

* The capacity and design of the system should ensure simultaneous action of such two sections.

In any case, pump capacity should be designed to simultaneously cover risk objects less than 3 m apart, also when arranged as separate sections.

.5 Nozzles and piping should not prevent access to engine or machinery for routine maintenance. In ships fitted with overhead hoists or other moving equipment, nozzles and piping should not be located to prevent operation of such equipment. (MSC.1/Circ.1387, An. par. 3.2.5)

3.4.4.3.3 System components

.1 The system should be available for immediate use and capable of continuously supplying water-based medium for at least 20 min in order to suppress or extinguish the fire and to prepare for the discharge of the main fixed fire-extinguishing system within that period of time. (MSC.1/Circ.1387, An. par. 3.3.1)

It is recommended, that the system be supplied with fresh water. Foam additives are accepted to enhance fire-extinguishing capability. The system may be supplied with seawater, after the first 20 min of the discharge. The ship should have a continuous supply of water to ensure the operation of the system with the highest capacity required to supply one/two of the sections for at least 20 min.

Dedicated fresh water accumulators with the extinguishing media stored under sufficient pressure at all time can be used for this purpose.

An arrangement where a water pump is supplied from main and emergency source of electrical power or driven by dedicated diesel engine may be accepted as equivalent solution.

If a tank for other purposes is used, e.g. a sanitary water tank, there should be a liquid level indicator on the tank with an alarm signaling the low water level in the tank.

.2 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered in machinery spaces. Components within the protected spaces should be designed to withstand the elevated temperatures which could occur during a fire. Components should be tested in accordance with the listed sections of appendix A of MSC/Circ.1165, as amended by MSC.1/Circ.1269, as modified in par. 3.3.2 of MSC.1/Circ.1387. (MSC.1/Circ.1387, An. par. 3.3.2)

.3 The system and its components should be designed and installed based on international standards acceptable to the Organization*, and manufactured and tested in accordance with the appropriate elements of the appendix to MSC.1/Circ.1387 (these Guidelines) (MSC.1/Circ.1387, An. par. 3.3.3)

* Pending the development of international standards acceptable to the IMO national standards as prescribed by the Administration should be applied.

.4 The electrical components of the pressure source for the system should have a minimum rating of IPX4** if located in the protected space. Systems requiring an external power source need only be supplied by the main power source. (MSC.1/Circ.1387, An. par. 3.3.4) It is recommended, that the water supplying pump, control and alarm signaling system should be supplied from the main and emergency source of electric power, and it is to be possible to automatically change the power source.

** X means the characteristic numeral used to mark the degree of protection against access to hazardous parts and ingress of solid foreign objects, which could be 0.1 to 6.

.5 The water supply for local application systems may be fed from the supply to a water-based main fire-fighting system, providing that adequate water quantity and pressure are available to operate both systems for the required period of time. Local application systems may form a section(s) of a water-based main fire-extinguishing system provided that all requirements of sec. 3.4.3 for main system (SOLAS reg. II-2/10.5), these Guidelines, and MSC/Circ.1165, as amended by MSC.1/Circ.1237 and MSC.1/Circ.1269) are met, and the systems are capable of being isolated from the other sections of the main system. (MSC.1/Circ.1387/Corr.1, An. par. 3.3.5)

.6 A means for testing the operation of the system for assuring the required pressure and flow should be provided. (MSC.1/Circ.1387/Corr.1, An. par. 3.3.6)
For the purposes of checking the water flow, a test valve should be installed on the discharge side of the pump, with a diameter that allows the water to flow with the greatest efficiency at the required pressure.

.7 Spare parts and operating and maintenance instructions for the system should be provided as recommended by the manufacturer. (MSC.1/Circ.1387/Corr.1, An. par. 3.3.7)

.8 A fitting should be installed on the discharge piping of open head systems to permit blowing air through the system during testing to check for possible obstructions. (MSC.1/Circ.1387/Corr.1, An. par. 3.3.8)

3.4.4.4 Piping

3.4.4.4.1 All piping and couplings should be protected internally and externally against corrosion.

3.4.4.4.2 A test valve should be provided with means to secure it in a closed position after use.

3.4.4.4.3 An air connection and drain valve(s) shall be provided ensuring that all parts of the piping system can be drained and blown through with air after testing. All parts of the piping system should be self-draining to drain valves or open nozzles.

3.4.4.5 The operation procedures for the system

The following procedures should be included in operating instructions, which should be stored in the engine control room:

- description of the operation of the system;
- how many sections that can be released simultaneously, based on available pump or accumulator capacity;
- recommendations for stop of ventilation;
- guidelines for when and how to use the main firefighting system in case the local application system will not able to extinguish the fire.

3.4.4.6 Tests of the system after installation on board

3.4.4.6.1 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.4.4.6.2 After installation on board, the system is subject to functional tests in operation of water supplying pump, water accumulator, section valves, alarms and indication, based on agreed acceptance and test program.

3.4.5 Local application water-spraying fire-extinguishing system for exhaust gas fired thermal heaters (boilers)

3.4.5.1 The system is to ensure that sprayed water is supplied to the external surfaces of the heater/ boiler at an intensity of at least 5 $l/\text{m}^2/\text{min}$.

3.4.5.2 The system shall be ready for immediate use and shall enable the supply of water with full capacity for at least 20 minutes. It is recommended that the extinguishing agent be fresh water.

3.4.5.3 Water-spraying nozzles are to ensure even water supply to the hot surfaces of the boiler. The nozzles are to be so arranged that the elements of the machinery space equipment do not constitute an obstacle to the sprayed water.

3.4.5.4 In order to prevent uncontrolled discharge of water onto the hot surfaces of the boiler, two shut-off valves are to be installed in the supply pipeline, between which there is to be a drain cock. Other equivalent solution can be accepted.

3.4.5.5 The system shall be started manually. Control valves and the device for starting the pump (if provided) should be in one easily accessible place, at a safe distance from the boiler.

Operation instructions for the system shall be displayed at the place of starting device.

The location of starting device of the system should be marked with the symbol used in *Fire Control Plan*.

3.4.5.6 The flue gas pipe below the boiler is to be provided with a suitable cover to collect and drain water to prevent water flooding to the engine. The water should be drained to the bilge in the machinery space or to a suitable drain tank.

3.4.5.7 Activation of the system shall set off the alarm in the machinery space and in a continuously manned control station.

3.4.5.8 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.4.5.9 After installation on board, the system is subject to functional tests, based on agreed acceptance and test program.

3.4.6 Water-spraying fire-extinguishing system for container ships with open-top container holds

3.4.6.1 Below guidelines are based on MSC/Cir.608/Rev.1. PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.4.6.2 "Open-top containership": means a containership especially designed so that one or more of the cargo holds need not be fitted with hatch covers. (MSC/Circ.608/Rev.1, An.1.1)

3.4.6.3 The water spraying system should be able to effectively contain a fire in the container bay of origin and to cool adjacent areas to prevent structural damage. (MSC/Circ.608/Rev.1, An. par. 9.1)

3.4.6.4 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. If found necessary, full-scale test of the system may be required. (MSC/Circ.608/Rev.1, An. par. 9.2)

3.4.6.5 The system shall be subdivided, with each subdivision to consist of a ring-line at deck level in an open cargo hold around a container bay. (MSC/Circ.608/Rev.1, An. par. 9.3)

The location of the section valves manifold should be indicated with the symbol used on *Fire Control Plan*.

On each section valve, clear marking plate indicating the section number served should be provided.

3.4.6.6 The water spray 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 uniform application density shall not be less than 1.1 litres/min/m^2. (MSC/Circ.608/Rev.1, An. par. 9.4)

3.4.6.7 At least one dedicated fire extinguishing pump for the hold water spray system with a capacity to serve all container bays in any one open-top container hold simultaneously shall be provided. The pump(s) shall be installed outside the open-top area. (MSC/Circ.608/Rev.1, An. par. 9.4)

3.4.6.8 The availability of water to the water spray system shall be at least 50 pr cent 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 water spray pump, this may be accomplished by an interconnection to an alternative source of water. The extinguishing system shall be supplemented by hose supply from the weather deck. (MSC/Circ.608/Rev.1, An. par. 9.4)

3.4.6.9 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.4.6.10 After installation on board, the system is subject to functional tests, based on agreed acceptance and test program.

3.4.7 Fixed pressure water-spraying and water-based fire-extinguishing systems for cabin balconies

3.4.7.1 General

3.4.7.1.1 Below guidelines are based on MSC.1/Cir.1268. PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.4.7.1.2 Fixed pressure water-spraying fire-extinguishing systems, as required by par. 11.1.10.4 (SOLAS reg. II-2/10.6.1.3), for the protection of cabin balconies where furniture and furnishings other than those of restricted fire risk are used should be shown by testing to have the capability of suppressing typical fires expected in such areas, and preventing them from spreading to the adjacent cabins and to other balconies. (MSC.1/Circ.1268, An. par.1)

3.4.7.1.3 Fixed pressure water-spraying and water-based fire-extinguishing systems for cabin balconies shall be approved by the Administration based on the guidelines developed by the IMO*.

* Refer to the *Guidelines for the approval of fixed pressure water-spraying and water-based fire-extinguishing systems for cabin balconies* - MSC.1/Circ.1268, as amended.

3.4.7.2 Definitions

For the purposes of this section 3.4.7, the following definitions apply:

.1 ***Automatic system*** is a system with automatic nozzles. Each head should be individually activated by heat from the fire before water will be discharged. (MSC.1/Circ.1268, An. par. 1.2.1)

.2 ***Manually released system*** is a pipework system with open nozzles, controlled by section valves. When a section valve is opened, all of the connected nozzles will discharge water simultaneously. (An. par. 1.2.2)

3.4.7.3 Principal requirements for the system

3.4.7.3.1 The system should either be automatic or capable of manual release from a location remote from the protected area. (An. par. 2.1)

3.4.7.3.2 The system should be capable of fire suppression based on testing conducted in accordance with the appendix to MSC.1/Circ.1268 (these Guidelines). (An. par. 2.2)

3.4.7.3.3 The system should be capable of fire suppression on open deck areas with expected wind conditions while the vessel is underway. The fire test does not require the use of actual wind velocities; instead, a nominal wind speed is included to account for variables in balcony geometry and related issues. Although the test ventilation conditions are intended to provide a safety factor, it is recognized that in an actual fire, the master and crew are expected to take appropriate actions to manoeuvre the ship to assist the suppression system. (An. par. 2.3)

3.4.7.3.4 The system should be available for immediate use and capable of continuously operating for at least 30 min. (An. par. 2.4)

3.4.7.3.5 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered on open deck areas. Open head nozzles should be tested in accordance with appendix A of MSC/Circ.1165*. Automatic nozzles should be tested in accordance with appendix 1 of resolution A.800(19)* (An. par. 2.5)

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* These IMO instruments have been amended by MSC/Circ.1269 and resolution MSC.265(84), respectively.

3.4.7.3.6 The location, type and characteristics of the nozzles should be within the limits tested, as referred to in the appendix. Nozzle positioning should take into account obstructions to the spray of the fire-fighting system. Automatic nozzles should have fast response characteristics as defined in ISO standard 6182-1:2004. (An. par. 2.6)

3.4.7.3.7 The piping system should be sized in accordance with a hydraulic calculation technique such as the Hazen-Williams hydraulic calculation technique* and the Darcy-Weisbach hydraulic calculation technique, to ensure availability of flows and pressures required for correct performance of the system. (An. par. 2.7)

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* Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	C
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

3.4.7.3.8 The minimum capacity and design of the supply system for a manually released system should be based on the complete protection of the most hydraulically demanding section. The minimum capacity and design of the supply system for an automatic system should be based on the complete protection of the eight most hydraulically remote balconies, but not to exceed 50m^2. (An. par. 2.8)

3.4.7.3.9 The water supply for cabin balcony systems may be fed from an independent supply, or they may be fed from the supply to another water-based fire-fighting system providing that adequate water quantity and pressure are available as indicated below:

.1 Manually released systems: The water supply should be capable of supplying the largest balcony section and, if supplied by the sprinkler system, the capacity should be adequate to supply eight adjacent cabins. If supplied by the fire main, the system should be capable of supplying the largest balcony section plus the two jets of water required by SOLAS reg. II-2/10.2.1.3 and II-2/10.2.1.6.

.2 Automatic systems: The water supply should be capable of supplying the eight most hydraulically demanding balconies, but not to exceed 50 m^2. If combined with the sprinkler system, the design area in total need not exceed 280 m^2. (An. par. 2.9)

3.4.7.3.10 The system should be grouped into sections. A manually released section should not serve cabin balconies on both sides of the ship, except that the same section may serve balconies located on one side of the ship and balconies in the fore or aft end of the ship. (An. par. 2.10)

3.4.7.3.11 The system section valves and operation controls should be located at easily accessible positions outside the protected space, not likely to be cut off by a fire in the cabin balconies. (An. par. 2.11)

On each section valve, clear marking plate indicating the section number served should be provided.

3.4.7.3.12 A means for testing the operation of the system for assuring the required pressure and flow should be provided. (An. par. 2.12)

3.4.7.3.13 Activation of any water supply pump should give a visual and audible alarm at a continuously manned central control station or onboard safety centre. (An. par. 2.13)

3.4.7.3.14 Any parts of the system which may be subjected to freezing temperatures in service should be suitably protected against freezing. (An. par. 2.14)

3.4.7.3.15 The system should be provided with a redundant means of pumping or otherwise supplying the discharge nozzles. The capacity of the redundant means should be sufficient to compensate for the loss of any single pump or supply source. The system should be fitted with a permanent sea inlet and be capable of continuous operation using seawater. (An. par. 2.15)

3.4.7.3.16 Operating instructions for the system should be displayed at each operating position.

3.4.7.3.17 Spare parts and operating and maintenance instructions for the system should be provided as recommended by the manufacturer. (An. par. 2.17)

3.4.7.3.18 Dry pipe systems should be arranged such that water will discharge from the farthest sprinkler within 60 s of actuation of the sprinkler. (An. par. 2.18)

3.4.7.4 Tests of the system after installation on board

3.4.7.4.1 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.4.7.4.2 After installation on board, the system is subject to functional tests in operation of water supplying pump, section valves, alarms and indication, based on agreed acceptance and test program.

3.4.8 Water screen system

3.4.8.1 The water screen system is intended to be used in the following cases:

.1 in ships with industrial spaces – to provide a “water wall” in such spaces, where is not possibly to install “A-60” class divisions;

.2 in ships adapted to work in high temperature or crude oil/ chemical spillage areas – to spray the outer walls of the superstructure.

3.4.8.2 The intensity of water supply through the system shall be taken as follows:

- 70 *l*/min per running meter wall, to fully replace “A-60” class division;
- 30 *l*/min per running meter wall, for one-side drenching of “A-0” class division.

3.4.8.3 The system may be supplied from the water fire main system, and in the case of small water screens – also from sea water or fresh water hydrophore system.

3.4.8.4 The devices for activating the water screen system are to be located in easily accessible and safe places.

The location of activating the water screen system devices should be marked with the symbol used on *Fire Control Plan*.

3.4.8.5 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.4.8.6 After installation on board, the system is subject to functional tests, based on agreed acceptance and test program.

3.5 Fixed foam fire-extinguishing systems

3.5.1 Application and general requirements

This sub-chapter 3.5 (chapter) details the specifications for fixed foam fire-extinguishing systems for the protection of machinery spaces, cargo spaces, cargo pump-rooms and vehicle, special category and ro-ro spaces. This chapter does not apply to cargo pump-rooms of chemical tankers carrying liquid cargoes referred to in SOLAS reg. II-2/1.6.2, unless the Administration specifically accepts the use of these systems based on additional tests with alcohol-based fuel and alcohol resistant foam. (FSS Code, Ch. 6/1)

3.5.2 Definitions

For the purposes of this sub-chapter 3.5, the following definitions apply:

.1 ***Design filling rate*** is at least the minimum nominal filling rate used during the approval tests. (FSS Code, Ch. 6/2.1)

.2 ***Foam*** is the extinguishing medium produced when foam solution passes through a foam generator and is mixed with air. (FSS Code, Ch. 6/2.2)

.3 ***Foam solution*** is a solution of foam concentrate and water. (FSS Code, Ch. 6/2.3)

.4 ***Foam concentrate*** is a liquid which, when mixed with water in the appropriate concentration forms a foam solution. (FSS Code, Ch. 6/2.4)

.5 ***Foam delivery ducts*** are supply ducts for introducing high-expansion foam into the protected space from foam generators located outside the protected space. (FSS Code, Ch. 6/2.5)

.6 ***Foam mixing ratio*** is the percentage of foam concentrate mixed with water forming the foam solution. (FSS Code, Ch. 6/2.6)

.7 ***Foam generators*** are discharge devices or assemblies through which high-expansion foam solution is aerated to form foam that is discharged into the protected space. Foam generators using inside air typically consist of a nozzle or set of nozzles and a casing. The casing is typically made of perforated steel/stainless steel plates shaped into a box that enclose the nozzle(s). Foam generators using outside air typically consist of nozzles enclosed within a casing that spray onto a screen. An electric, hydraulic or pneumatically driven fan is provided to aerate the solution. (FSS Code, Ch. 6/2.7)

.8 ***High-expansion foam fire-extinguishing systems*** are fixed total flooding extinguishing systems that use either inside air or outside air for aeration of the foam solution. A high-expansion foam system consists of both the foam generators and the dedicated foam concentrate approved during the fire testing specified in par. 3.5.3.1.3. (FSS Code, Ch. 6/2.8)

.9 ***Inside air foam system*** is a fixed high-expansion foam fire-extinguishing system with foam generators located inside the protected space and drawing air from that space. (FSS Code, Ch. 6/2.9)

.10 ***Nominal flow rate*** is the foam solution flow rate expressed in l/min. (FSS Code, Ch. 6/2.10)

.11 ***Nominal application rate*** is the nominal flow rate per area expressed in l/min/m^2. (FSS Code, Ch. 6/2.11)

.12 ***Nominal foam expansion ratio*** is the ratio of the volume of foam to the volume of foam solution from which it was made, under non-fire conditions, and at an ambient temperature of e.g. around 20°C. (FSS Code, Ch. 6/2.12)

.13 ***Nominal foam production*** is the volume of foam produced per time unit, i.e. nominal flow rate times nominal foam expansion ratio, expressed in m^3/min. (FSS Code, Ch. 6/2.13)

.14 ***Nominal filling rate*** is the ratio of nominal foam production to the area, i.e. expressed in m/min. (FSS Code, Ch. 6/2.14)

.15 ***Nominal filling time*** is the ratio of the height of the protected space to the nominal filling rate, i.e. expressed in minutes. (FSS Code, Ch. 6/2.15)

.16 ***Outside air foam system*** is a fixed high-expansion foam system with foam generators installed outside the protected space that are directly supplied with fresh air. (FSS Code, Ch. 6/2.16)

.17 ***Low-expansion foam*** is foam with expansion ratio up to 20 (generally about 10).

.18 ***Medium-expansion foam*** is foam with expansion ratio between 20 and 200 (generally about 100).

.19 ***High-expansion foam*** is foam with expansion higher than 200 (generally about 500).

.20 ***Alcohol resistant foam concentrate*** is foam concentrate used for extinguishing fires of water-miscible flammable liquids (polar liquids) and fires of other liquids, that destroy the typical foam.

3.5.3 Fixed high-expansion foam fire-extinguishing systems

3.5.3.1 Principal performance

3.5.3.1.1 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 water-based local application systems required by sec. 6.2.7 (SOLAS reg. II-2/10.5.6) from interfering with the effectiveness of the system. (FSS Code, Ch. 6/3.1.1)

3.5.3.1.2 The foam concentrates shall be approved by the Administration based on the guidelines developed by Organization*. Different foam concentrate types shall not be mixed in a high-expansion foam system. (FSS Code, Ch. 6/3.1.2)

* Refer to the *Guidelines for the performance and testing criteria and surveys of high-expansion foam concentrates for fixed fire-extinguishing systems* - MSC/Circ.670.

3.5.3.1.3 The system shall be capable of fire extinction and manufactured and tested to the satisfaction of the Administration based on the guidelines developed by Organization**. (FSS Code, Ch. 6/3.1.3)

** Refer to the *Guidelines for the approval of fixed high-expansion foam systems* - 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. (FSS Code, Ch. 6/3.1.4)

3.5.3.1.5 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 full galvanized steel or equivalent. Distribution pipework shall have self-draining capability. (FSS Code, Ch. 6/3.1.5)

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. (FSS Code, Ch. 6/3.1.6)

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. (FSS Code, Ch. 6/3.1.7)

The min. level of foam concentrate shall be marked on the storage tank level indicator.

The location of foam concentrate storage tank should be indicated 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. (FSS Code, Ch. 6/3.1.8)

Location of remote control of the high-expansion foam system should be marked with symbols used on *Fire Control Plan.*

3.5.3.1.9 Spare parts shall be provided based on the manufacturer's instruction. (FSS Code, Ch. 6/3.1.9)

3.5.3.1.10 If an internal combustion engine is used as a prime mover for the seawater pump for the system, the fuel oil tank to the prime mover 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. (FSS Code, Ch. 6/3.1.10)

The min. level of fuel oil shall be marked on the fuel oil tank level indicator.

3.5.3.1.11 The arrangement of foam generators and piping in the protected space shall not interfere with access to the installed machinery for routine maintenance activities. (FSS Code, Ch. 6/3.1.11)

Location of foam generators should be marked with 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. (FSS Code, Ch. 6/3.1.12)

3.5.3.1.13 The piping system shall be sized in accordance with a hydraulic calculation technique * to ensure availability of flows and pressures required for correct performance of the system. (FSS Code, Ch. 6/3.1.13)

* Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	C
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

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^3 need not comply with this requirement. (FSS Code, Ch. 6/3.1.14)

3.5.3.1.15 Onboard procedures shall be established to require personnel re-entering the protected space after a system discharge to wear breathing apparatus to protect them from oxygen deficient air and products of combustion entrained in the foam blanket. (FSS Code, Ch. 6/3.1.15)

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 spaces covered and the location of the zone in respect of each section. Instructions for testing and maintenance shall be available on board. (FSS Code, Ch. 6/3.1.16)

Operating manuals should contain the following information:

.1 before starting the system, make sure the water-based local application system (if provided) is shut down. It is forbidden to use a foam system and a water-based local application system at the same time due to the reduced effectiveness of foam extinguishing;

.2 after starting the system, the air vents/ openings in the upper part of the protected space should remain open in order to remove the air from the space. After filling the space with foam, all air vents/ openings should be closed.

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. (FSS Code, Ch. 6/3.1.17)

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. (FSS Code, Ch. 6/3.1.18)

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. (FSS Code, Ch. 6/3.1.19)

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. (FSS Code, Ch. 6/3.1.20)

3.5.3.1.21 A space/spaces protected by the high-expansion foam fire-extinguishing system should be indicated by a plate on the space/spaces entrance door, with the symbol used on *Fire Control Plan*.

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. (FSS Code, Ch. 6/3.2.1.1)

3.5.3.2.1.2 Sufficient foam-generating capacity shall be provided to ensure 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. (FSS Code, Ch. 6/3.2.1.2)

Note:
* Interpretations regarding the largest protected space are given in MSC.1/1528 and IACS UI SC262.

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 with only one foam generator. (FSS Code, Ch. 6/3.2.1.3)

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. (FSS Code, Ch. 6/3.2.1.4)

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. (FSS Code, Ch. 6/3.2.2.1)

3.5.3.2.2.2 Sufficient foam-generating capacity shall be provided to ensure 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. However, for systems protecting vehicle and ro-ro spaces and special category spaces, with decks that are reasonably gas-tight and that have a 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. (FSS Code, Ch. 6/3.2.2.2)

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. (FSS Code, Ch. 6/3.2.2.3)

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 testing 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. (FSS Code, Ch. 6/3.2.2.4)

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. (FSS Code, Ch. 6/3.2.2.5)

3.5.3.3 Outside air foam systems

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. (FSS Code, Ch. 6/3.3.1.1)

3.5.3.3.1.2 Sufficient foam-generating capacity shall be provided to ensure 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. (FSS Code, Ch. 6/3.3.1.2)

Note:
* Interpretations regarding the largest protected space are given in MSC.1/1528 and IACS UI SC262.

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 testing 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 with only one duct. (FSS Code, Ch. 6/3.3.1.3)

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. (FSS Code, Ch. 6/3.3.1.4)

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 class "A-60" rated. 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. (FSS Code, Ch. 6/3.3.1.5)

3.5.3.3.1.6 The foam generators shall be located where an adequate fresh air supply can be arranged. (FSS Code, Ch. 6/3.3.1.6)

3.5.3.3.2 Systems for the protection of vehicle and ro-ro spaces and special category and cargo 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. (FSS Code, Ch. 6/3.3.2.1)

3.5.3.3.2.2 Sufficient foam-generating capacity shall be provided to ensure 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. However, for systems protecting vehicle and ro-ro spaces and special category spaces, with decks that are reasonably gas-tight and that have a 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. (FSS Code, Ch. 6/3.3.2.2)

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. (FSS Code, Ch. 6/3.3.2.3)

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 testing 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. (FSS Code, Ch. 6/3.3.2.4)

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. (FSS Code, Ch. 6/3.3.2.5)

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 class "A-60" rated. 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. (FSS Code, Ch. 6/3.3.2.6)

3.5.3.3.2.7 The foam generators shall be located where an adequate fresh air supply can be arranged. (FSS Code, Ch. 6/3.3.2.7)

3.5.3.4 Installation testing requirements

3.5.3.4.1 After installation, the pipes, valves, fittings and assembled systems shall be tested to the satisfaction of the Administration, including functional testing of the power and control systems, water pumps, foam pumps, valves, remote and local release stations and alarms. Flow at the required pressure shall be verified for the system using orifices fitted to the test line. In addition, all distribution piping shall be flushed with freshwater and blown through with air to ensure that the piping is free of obstructions. (FSS Code, Ch. 6/3.4.1)

3.5.3.4.2 Functional 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 0ºC and density equal to or less than 1,100 kg/m^3, this test can be performed with water instead of foam concentrate. Other arrangements shall be tested with the actual foam concentrate. (FSS Code, Ch. 6/3.4.2)

3.5.3.5 Systems using outside air with generators installed inside the protected space

Systems using outside air but with generators located inside the protected space and supplied by fresh air ducts may be accepted by the Administration provided that these systems have been shown to have performance and reliability equivalent to systems defined in sec. 3.5.3.3 (3.3). For acceptance, the Administration should consider the following minimum design features:

.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. (FSS Code, Ch. 6/3.5)

3.5.4 Fixed low-expansion foam fire-extinguishing systems

3.5.4.1 Quantity and foam concentrates

3.5.4.1.1 The foam concentrates of low-expansion foam fire-extinguishing systems shall be approved by the Administration based on the guidelines adopted by Organization*. Different foam concentrate types shall not be mixed in a low-expansion foam system. Foam concentrates of the same type from different manufacturers shall not be mixed unless they are approved for compatibility. (FSS Code, Ch. 6/3.4.1.1)

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

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. (FSS Code, Ch. 6/3.4.1.2)

3.5.4.2 Installation requirements

3.5.4.2.1 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 to the Administration through calculation or by testing. (FSS Code, Ch. 6/4.2.1)

3.5.4.2.2 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. (FSS Code, Ch. 6/4.2.2)

The location of the low-expansion foam system remote control should be indicated with the symbol used on *Fire Control Plan*.

3.5.4.3 Tests of the system after installation on board

3.5.4.3.1 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.5.4.3.2 After installation on board, the low-expansion foam system is subject to functional tests, based on agreed acceptance and test program.

3.6 Fixed gas fire-extinguishing systems

3.6.1 General

3.6.1.1 Fire-extinguishing medium

3.6.1.1.1 Clean extinguishing agents, i.e. chemical compounds from the group of halogen derivatives of hydrogen (e.g. FM-200, NOVEC, FE-36, etc.), inert gases (CO_2, nitrogen, argon, etc.) or mixtures thereof, shall be used as the extinguishing agents in fixed gas fire-extinguishing systems.

3.6.1.1.2 Fire-extinguishing systems using Halon 1211, 1301, and 2402 and perfluorocarbons shall be prohibited. (SOLAS II-2/10.4.1.3)

3.6.1.1.3 In general, the Administration shall not permit the use of steam as a fire-extinguishing medium in fixed fire-extinguishing systems. Where the use of steam is permitted by the Administration, it shall be used only in restricted areas as an addition to the required fire-extinguishing system and shall comply with the requirements of sec. 3.6.2.10 (FTP Code). (SOLAS II-2/10.4.1.4)

3.6.1.1.4 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 these spaces are separated from each other*. The system shall be fitted with normally closed control valves arranged to direct the agent into the appropriate space. Adjacent spaces with independent ventilation systems not separated by at least "A-0" class divisions should be considered as the same space. (FSS Code, Ch. 5/2.1.1.1)

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* ***IMO interpretation***

Two spaces can be considered as separated spaces where fire divisions as required by SOLAS reg. II-2/9.2.2, 9.2.3 and 9.2.4, as appropriate, or divisions of steel are provided between them. (MSC.1/Circ.1120)

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.

3.6.1.1.5 The volume of starting air receivers, converted to free air volume, shall be added to the gross volume of the machinery space when calculating the necessary quantity of the fire-extinguishing medium. Alternatively, a discharge pipe from the safety valves may be fitted and led directly to the open air. (FSS Code, Ch. 5/2.1.1.2)

3.6.1.1.6 Means shall be provided for the crew to safely check the quantity of the fire-extinguishing medium in the containers. It shall not be necessary to move the containers completely from their fixing position for this purpose. For carbon dioxide systems, hanging bars for a weighing device above each bottle row, or other means shall be provided. For other types of extinguishing media, suitable surface indicators may be used. (FSS Code, Ch. 5/2.1.1.3)

In the room where containers with fire-extinguishing medium are located, adequate free space should be provided above the containers, in order to enable the containers to be replaced.

3.6.1.1.7 Containers for the storage of fire-extinguishing medium, piping and associated pressure components shall be designed to pressure codes of practice to the satisfaction of the Administration* having regard to their locations and maximum ambient temperatures expected in service. (FSS Code, Ch. 5/2.1.1.4)
It is assumed that the maximum temperature expected in service may be 55°C.

* Recommended Publications:

ISO 9809/1: *Refillable seamless steel gas cylinders (design, construction and testing);*

ISO 3500: *Seamless steel CO2 cylinders. For fixed fire-fighting installations on ships, specifying the principal external dimensions, accessories, filling ratio and marking for seamless steel CO2 cylinders used in fixed fire-fighting installations on ships, in order to facilitate their interchange ability;*

ISO 5923: *Fire protection Fire-extinguishing media Carbon dioxide;*

ISO 13769: *Gas cylinders Stamp marking; ISO 6406: Periodic inspection and testing of seamless steel gas cylinders;*

ISO 9329, part 1*: Seamless steel tubes for pressure purposes - Technical delivery conditions Part 1: Unalloyed steels with specified room temperature properties;*

ISO 9329, part 2: *Seamless steel tubes for pressure purposes - Technical delivery conditions Part 2: Unalloyed and alloyed steels with specified elevated temperature properties;*

ISO 9330, part 1: *Welded steel tubes for pressure purposes - Technical delivery conditions Part 1: Unalloyed steel tubes with specified room temperature properties;*

ISO 9330, part 2: *Welded steel tubes for pressure purposes - Technical delivery conditions Part 2: Electric resistance and induction welded unalloyed and alloyed steel tubes with specified elevated temperature properties.*

3.6.1.2 Installation requirements

3.6.1.2.1 The piping for the distribution of fire-extinguishing medium shall be arranged and discharge nozzles so positioned that a uniform distribution of the medium is obtained. System flow calculations shall be performed using a calculation technique acceptable to the Administration. (FSS Code, Ch. 5/2.1.2.1)

3.6.1.2.2 Except as otherwise permitted by the Administration, pressure containers required for the storage of fire-extinguishing medium, other than steam, shall be located outside the protected spaces in accordance with sec. 3.6.1.5 (SOLAS reg. II-2/10.4.3). (FSS Code, Ch. 5/2.1.2.2)

3.6.1.2.3 Spare parts for the system shall be stored on board and be to the satisfaction of the Administration. (FSS Code, Ch. 5/2.1.2.3)

3.6.1.2.4 In piping sections where valve arrangements introduce sections of closed piping, such sections shall be fitted with a pressure relief valve and the outlet of the valve shall be led to open deck. (FSS Code, Ch. 5/2.1.2.4)

3.6.1.2.5 All discharge piping, fittings and nozzles in the protected spaces shall be constructed of materials having a melting temperature which exceeds 925°C. The piping and associated equipment shall be adequately supported. (FSS Code, Ch. 5/2.1.2.5)

3.6.1.2.6 A fitting shall be installed in the discharge piping to permit the air testing as required by par. 3.6.2.8.2.1 (FSS Code par.2.2.3.1). (FSS Code, Ch. 5/2.1.2.6)

3.6.1.3 System control requirements

3.6.1.3.1 Fixed gas fire-extinguishing system shall be operated manually. The necessary pipes for conveying fire-extinguishing medium into the protected spaces shall be provided with control valves so marked as to indicate clearly the spaces to which the pipes are led. Suitable provisions shall be made to prevent inadvertent release of the medium into the space. Where a cargo space fitted with a gas fire-extinguishing system is used as a passenger space, the gas connection shall be blanked during such use. The pipes may pass through accommodations providing that they are of substantial thickness and that their tightness is verified with a pressure test, after their installation, at a pressure head not less than 5 N/mm^2. In addition, pipes passing through accommodation areas shall be joined only by welding and shall not be fitted with drains or other openings within such spaces. The pipes shall not pass through refrigerated spaces. (FSS Code, Ch. 5/2.1.3.1)

3.6.1.3.2 Means shall be provided for automatically giving audible and visual warning of the release of fire-extinguishing medium into any ro-ro spaces, container holds equipped with integral reefer containers, spaces accessible by doors or hatches, and other spaces in which personnel normally work or to which they have access[1)]. The audible alarms shall be located so as to be audible throughout the protected space with all machinery operating, and the alarms* should be distinguished from other audible alarms by adjustment of sound pressure or sound patterns. The pre-discharge alarm[2)] shall be automatically activated (e.g., by opening of the release cabinet door). The alarm 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. Conventional cargo spaces[3)] and small spaces (such as compressor rooms, paint lockers, etc.) with only a local release need not be provided with such an alarm. (FSS Code, Ch. 5/2.1.3.2)

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* See *Code on Alerts and Indicators, 2009,* adopted by IMO Resolution A.1021 (26).

**** IACS and IMO interpretations***

1) *Ordinary cargo holds need not comply with this requirement. However, ro-ro cargo spaces, holds in container ships equipped for integrated reefer containers and other spaces where personnel can be expected to enter and where the access is therefore facilitated by doors or manway hatches should comply with the above regulation. (MSC/Circ.1120) and (IACS UI SC25)*

2) *Interpretation on pre-discharge alarm:*

1 "The pre-discharge alarm" may be activated before the two separate system release controls are operated (e.g. by a micro-switch that activates the pre-discharge alarm upon opening the release cabinet door as per paragraph 2.1.3.2 of FSS Code). Therefore, the two separate controls for releasing carbon dioxide into the protected space (i.e. one control to open the valve of the piping which conveys the gas into the protected space and a second control used to discharge the gas from its storage containers) as per paragraph 2.2.2 can be independent of the control for activating the alarm.

2 A single control for activation of the alarm is sufficient. (IACS UI SC252, MSC.1/Circ.1456)

Time of operation of pre-discharge alarm should be counted from the moment the warning signal is turned on (opening the control cabinet or opening the directional valve).

If electrical time-delay device is used, it should be supplied from uninterrupted power system (UPS).

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) *Conventional cargo spaces means cargo spaces other than ro-ro spaces or container holds equipped with integral reefer containers, and they need not be provided with means for automatically giving audible and visual warning of the release. (…) (IACS UI SC132, MSC.1/Circ.1487)*

3.6.1.3.3 The means of control of any fixed gas fire-extinguishing system shall be readily accessible, 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 a protected space*. At each location there shall be clear instructions relating to the operation of the system having regard to the safety of personnel, including pre-start procedures. (FSS Code, Ch. 5/2.1.3.3)

Note:
* See interpretation in par. 3.6.1.5.1. (IACS UI SC204, MSC.1/Circ.1240)

3.6.1.3.4 There shall be a separate remote control panel/release box for each separately protected space, on which there shall be a plate with a clear name of the protected space.

Each remote control panel/release box of the fixed gas fire-extinguishing system should be indicated with the symbol used on *Fire Control Plan*.

3.6.1.3.5 Where the protected space is provided with mechanical ventilation, the opening of the control panel/release box and opening the section 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 should be supplied from uninterrupted power system (UPS).

3.6.1.3.6 It should be on board operation manual for each fire-extinguishing system prepared by its manufacturer, additionally containing a list of checks performed by the crew during periodic inspections and maintenance of the system during the ship's operation. The manual should also contain safety procedures prior to starting the system. The manual should be placed near the control devices of the system.

3.6.1.3.7 Automatic release of fire-extinguishing medium shall not be permitted, except as permitted by the Administration. (FSS Code, Ch. 5/2.1.3.4)

Automatic release can be permitted for local fire-extinguishing systems, treated as additional and independent of the required fixed fire-extinguishing systems in machinery spaces, installed over high fire risk equipment or in enclosed spaces of the machinery space which pose a high fire risk. After activating the local system, the concentration of the extinguishing medium must not exceed the concentration safe for the occupants of the space, which should be confirmed by adequate calculations.

3.6.1.4 Closing appliances for fixed gas fire-extinguishing systems

Where a fixed gas fire-extinguishing system is used, openings which may admit air to, or allow gas to escape from, a protected space shall be capable of being closed from outside the protected space. (SOLAS II-2/10.4.2)

These openings should be indicated with the symbol used on *Fire Control Plan*.

3.6.1.5 Storage rooms of fire-extinguishing medium

3.6.1.5.1 When the fire-extinguishing medium is stored outside a protected space, it shall be stored in a room which is located behind the forward collision bulkhead*, and is used for no other purposes. Any entrance to such a storage room shall preferably be from the open deck and shall be independent of the protected space. If the storage space is located below deck, it shall be located no more than one deck below the open deck and shall be directly accessible by a stairway or ladder from the open deck. (SOLAS II-2/10.4.3)

**** IACS and IMO interpretations***

Fire-extinguishing media protecting the cargo holds may be stored in a room located forward the cargo holds, but aft of the collision bulkhead, provided that both the local manual release mechanism and remote control(s) for the release of the media are fitted, and the latter is of robust construction or so protected as to remain operable in case of fire in the protected spaces. The remote controls 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 different cargo holds so protected shall be included in the remote release arrangement. (IACS UI SC204, MSC.1/Circ.1239)

3.6.1.5.2 Spaces which are located below deck or spaces where access from the open deck is not provided, shall be fitted with a mechanical ventilation system* designed to take exhaust air from the bottom of the space and shall be sized to provide at least 6 air changes per hour. (SOLAS II-2/10.4.3)

Ventilation ducts serving other spaces shall not be connected to the ventilation system of the storage room of fire-extinguishing medium.

The ventilation fan shall operate automatically by the opening of the 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 the fire-extinguishing agent will not be drawn into other ventilation outlets.

3.6.1.5.3 Access doors shall open outwards, and bulkheads and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and adjacent enclosed spaces shall be gastight. For the purpose of the application of tables regarding fire integrity of bulkheads separating adjacent spaces (SOLAS table 9.1 to 9.8), such storage rooms shall be treated as fire control stations. (SOLAS II-2/10.4.3)

3.6.1.5.4 The room shall be thermally insulated so that the temperature inside the room does not exceed +45°C. If for normal operation of the room equipment it is necessary to maintain a temperature above the freezing point, then the room shall be heated.

3.6.1.5.5 Means shall be provided for measuring temperature inside the room.

3.6.1.5.6 The room shall be locked; the key for the lock shall be kept in a break-glass-type closure, located near the entrance to the room.

3.6.1.5.7 The room shall be provided with means of communication with central control station, navigation bridge and machinery space.

3.6.1.5.8 The lighting of the room shall be supplied from the main and emergency source of electric power.

3.6.1.5.9 The room should be indicated by a plate, put on access door, with the symbol used on *Fire Control Plan*.

3.6.1.6 Protected spaces

3.6.1.6.1 Each entrance door/ hatch to a space protected by a gas fire-extinguishing system shall be provided with an warning sign with the following content:

"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_2) 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 should be indicated by a plate, placed on access door, with the symbol used on *Fire Control Plan*.

3.6.1.6.2 For systems requiring a high concentration of the extinguishing agent (CO_2, inert gases), to prevent excessive pressure in the protected space during the release of the extinguishing agent, it shall be possible to discharge air from the upper part of the space, e.g. through ventilation flaps, skylight in the machinery shaft, etc. The fire-extinguishing system operation manual shall specify which openings should be closed last after the extinguishing agent is total released into the room.

3.6.2 Carbon dioxide (CO_2) systems

In addition to the applicable general requirements given in sec. 3.6.1, CO_2 system shall comply with the requirements of this section 3.6.2.

3.6.2.1 Quantity of fire-extinguishing medium

3.6.2.1.1 For cargo spaces, the quantity of carbon dioxide available shall, unless otherwise provided, be sufficient to give a minimum volume of free gas equal to 30% of the gross volume of the largest cargo space to be protected in the ship. (FSS Code, Ch. 5/2.2.1.1)

3.6.2.1.2 For vehicle spaces and ro-ro spaces which are not special category spaces, the quantity of carbon dioxide available shall be at least sufficient to give a minimum volume of free gas equal to 45% of the gross volume of the largest such cargo space which is capable of being sealed, and the arrangements shall be such as to ensure that at least two thirds of the gas required for the relevant space shall be introduced within 10 min. (…) (FSS Code, Ch. 5/2.2.1.2)

3.6.2.1.3 For machinery spaces, the quantity of carbon dioxide carried shall be sufficient to give a minimum volume of free gas equal to the larger of the following volumes, either:

.1 40% of the gross volume of the largest machinery space so protected, the volume to exclude that part of the casing above the level at which the horizontal area of the casing is 40% or less of the horizontal area of the space concerned taken midway between the tank top and the lowest part of the casing; or

.2 35% of the gross volume of the largest machinery space protected, including the casing. (FSS Code, Ch. 5/2.2.1.3)

The amount of carbon dioxide (G), for individual spaces, shall be calculated according to the formula:

$$G = 1.79 \text{ x } V \text{ x } \varphi \text{ [kg]}$$

where:

V – design volume of the largest protected space – gross volume of the space, [m^3];

φ – fill factor:

φ = 0.35 – for typical machinery spaces, and for machinery spaces with casing for which the gross volume was assumed taking into account the volume of the casing;

φ = 0.4 – for machinery spaces with casing, the volume of which does not include the volume of casing above the level, at which the horizontal section area of the casing does not exceed 40% of the total machinery space area, taken midway between the tank top and the lowest part of the casing.

Note: The value of φ factor is to be taken where the amount of carbon dioxide (G) is greater.

3.6.2.1.4 The percentages specified in par. 3.6.2.1.3 (FSS Code, par. 2.2.1.2) above may be reduced to 35% and 30%, respectively, for cargo ships of less than 2,000 gross tonnage where two or more machinery spaces, which are not entirely separate, are considered as forming one space. (FSS Code, Ch. 5/2.2.1.4)

3.6.2.1.5 For the purpose of this paragraph the volume of free carbon dioxide shall be calculated at 0.56 m^3/kg. (FSS Code, Ch. 5/2.2.1.5)

3.6.2.1.6 For machinery spaces, the fixed piping system shall be such that 85% of the gas can be discharged into the space within 2 min. (FSS Code, Ch. 5/2.2.1.6)

3.6.2.1.7 For vehicle and ro-ro spaces capable of being sealed, the fixed piping system shall be such that at least two thirds (2/3) of the required quantity of gas can be discharged into the space within 10 min.

3.6.2.1.8 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 (2/3) of the gas 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 gas 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 gas to be discharged based on the loading condition of the hold.* (FSS Code, Ch. 5/2.2.1.7)

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* ***IMO interpretation***

It means, the number of setting points of control is three. (MSC.1/Circ.1528)

3.6.2.2 Controls

3.6.2.2.1 In addition to the applicable requirements given in par. 3.6.1.3, CO_2 system control shall comply with the requirements of this section 3.6.2.2.

3.6.2.2.2 Carbon dioxide systems for the protection of ro-ro spaces, container holds equipped with integral reefer containers, spaces accessible by doors or hatches, and other spaces in which personnel normally work or to which they have access 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 alarm. One control shall be used for opening the valve of the piping which conveys the gas into the protected space and a second control shall be used to discharge the gas from its storage containers. Positive means* shall be provided so they can only be operated in that order; and

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* ***IACS and IMO interpretation***

"The positive means" for the correct sequential operation of the controls, should be achieved by a mechanical and/or electrical interlock that does not depend on any operational procedure to achieve the correct sequence of operation. (IACS UI SC252, MSC.1/Circ.1456)

Where electrical interlock is used, it should be supplied from uninterrupted power supply (UPS)

.2 the two controls shall be located inside a release box clearly identified for the particular space. If the box containing the controls is to be locked, a key to the box shall be in a break-glass-type enclosure conspicuously located adjacent to the box. (FSS Code, Ch. 5/2.2.2)

Notes:

1. These requirements apply to the spaces identified in par. 3.6.1.3.2 (FSS Code, Ch. 5, par. 2.1.3.2). (IACS UI SC132, MSC.1/Circ.1487)
2. See also interpretations in par. 3.6.1.3.2. (IACS UI SC252, MSC.1/Circ.1456)

3.6.2.2.3 There shall be a separate remote release box for each separately protected space, in which personnel normally work or to which they have access. Release boxes should be located near exits doors from the protected spaces.

It is recommended, that at the control stations with release box, means of indication be provided, indicating whether the section valves are in the open or closed position.

On each section valve, clear marking plate indicating the spaces/ section number served should be provided.

Each release box should be capable to be locked by use of a key or other type means of lock.

If the release box requires electrical power, it should be supplied from the main and emergency power sources.

3.6.2.2.4 The pneumatic release box should consist of two (main and reserve) pilot cylinders, control valves and pilot line piping. The capacity of each pilot cylinder should be such as to reliably open the remotely operated section valves at the most unfavourable ambient temperature.

Pilot line pipelines should be steel welded or joined with welded mechanical joints and should not be led through spaces/ near equipment where they may be exposed to damage.

Only one pilot cylinder can be installed, if it has capacity to operate the system three times even under unfavorable ambient conditions.

3.6.2.2.5 CO_2 system, in addition to remote release, shall be capable of emergency activation from CO_2 storage room by manually opening the section valves and valve of each cylinder.

3.6.2.2.6 On ships of less than 500 gross tonnage, arrangement where the CO_2 storage room is readily accessible and section valves are located inside the storage room, additional remote release boxes are not required.

3.6.2.3 CO_2 cylinders

3.6.2.3.1 The total quantity of CO_2, calculated for the largest protected space, shall be stored in cylinders. The number of cylinders shall be selected taking into account their typical volume (80 *l*, 67 *l*, 45 *l*) and the filling ratio (i.e. the quantity of CO_2 per 1 *l* of the cylinder volume), which shall not exceed 0.67 kg/*l* – for the cylinders with design pressure 12.5 MPa and 0.75 kg/*l* – for the cylinders of design pressure 15 MPa or higher.

It is recommended that the CO_2 content in the cylinder should not exceed 45 kg, and the filling ratio – not exceed 0.67 kg/*l*.

All cylinders in the CO_2 cylinders storage room shall be of the same size.

3.6.2.3.2 Cylinders in the room shall be placed vertically in rows on insulation pads. These pads can be made of wood.

The cylinders shall be available for the inspection and control of the amount of carbon dioxide. All cylinders included in the system should be painted red and numbered.

3.6.2.3.3 Cylinders shall be fitted with safety valves or bursting disks, which operate/ burst at a pressure of 1.3 p (± 0.1%), where p means the cylinder design pressure.

If the CO_2 cylinders storage room is located below the open deck, the CO_2 outlet from the safety valves or cylinder bursting disks should be led through a pipeline outside the room.

The outlet end of the pipeline from the safety valves may not be placed in the vicinity of vents through which CO_2 could be sucked into the ship's spaces.

3.6.2.3.4 Each CO_2 cylinder shall be connected to the manifold by a flexible hose and a non-return valve. The non-return valve should be placed on the manifold so that a single cylinder can be disconnected from the manifold without preventing the operation of the entire system. The flexible hose is to be designed for the maximum pressure in the cylinder and should be of an approved type, in accordance with the requirements specified in sec. 1.5, of *Part VI*.

3.6.2.4 Pipes, fittings and CO_2 discharge nozzles

3.6.2.4.1 The main CO_2 pipeline from cylinders to distribution valves (manifold), together with the distribution valves, should be designed for a working pressure of at least 19.0 MPa and made of seamless steel pipes, with PRS certificate. Distribution valves should be steel, flange type.

The manifold with distribution valves should be pressure tested with a test pressure of 19.0 MPa.

The remaining CO_2 pipelines shall also be made of seamless steel pipes, but they can be delivered with steelworks' certificate.

The minimum wall thicknesses for steel pipes shall be in accordance with the values given in sec.1.5, Table 3 of *Part VI.*

3.6.2.4.2 CO_2 manifold shall be fitted with a pressure gauge, a connection (with a non-return valve) for blowing out the pipelines with compressed air and safety valve. The safety valve opening pressure shall be 13 MPa, and the diameter of the valve shall that excess CO_2 is drained off without increasing the pressure in the manifold. The outlet from the safety valves should comply with requirements given in par. 3.6.2.3.3.

3.6.2.4.3 Carbon dioxide shall be supplied to the protected spaces by means of discharge nozzles. The number of the nozzles and their arrangement in the protected space shall ensure even distribution of carbon dioxide. The nozzles shall be made steel or steel equivalent material.

3.6.2.4.4 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 also be fitted in the engine casing if there are devices and equipment in this casing, e.g. fuel-fired boilers, which pose a fire risk.

Nozzles shall not be placed over exit ladders and designated escape routes.

3.6.2.4.5 In cargo spaces, CO_2 nozzles shall be located in upper part of the space.

If CO_2 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 (movable loading platforms) are provided, the nozzles shall be located both in the upper and lower parts of the cargo spaces.

3.6.2.4.6 Water traps during CO_2 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.

3.6.2.4.7 On the main pipeline supplying CO_2 to the spaces where the crew is normally employed or to which the crew has access, for safety reasons, it is recommended to install an adjustable blanking flange, with a position indicator, enabling the CO_2 discharge to the spaces to be cut off during inspection and testing of the system. The plate with description “NORMALLY OPEN” shall be located on the flange.

3.6.2.5 CO_2 cylinders storage rooms

3.6.2.5.1 The storage rooms shall comply with sec. 3.6.1.5 and additionally with requirements, given below:

.1 they shall be provided with thermal insulation and ventilation so constructed that the temperature inside the room 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 room from outside. If a thermometer is provided, it should be placed in such a way that the temperature can be read both inside and outside the room, e.g. via an porthole.

3.6.2.6 The room should be provided with a posted system operating manual showing the diagram of the system, pipelines supplying CO_2 to each protected space, distribution valves and remote devices for starting the system. Additionally, the manual should contain the following information:

.1 the required quantity of CO_2 [kg] for the protection of the largest space and the total number of CO_2 cylinders required in the room;

.2 the number of CO_2 cylinders required to distribute CO_2 to each protected machinery space, served by separate pipe sections with distribution valves;

.3 safety procedures for the crew;

.4 list of openings which shall be closed in order to seal each protected before discharge of CO_2 to the space;

.5 proceedings in the case of emergency starting of the system if remote operation directly from release cabinet is not possible;

.6 proceedings to be followed by the crew after the use of CO_2 system;

.7 actions to be taken to make the system operable, after it use and fire suppression.

3.6.2.7 The CO_2 system operating manual for the protection of cargo holds shall additionally specify the number of cylinders required for the protection of each cargo hold for the following conditions:

.1 the cargo hold is empty;

.2 the cargo hold is 50% loaded;

.3 the cargo hold is 100% loaded.

3.6.2.8 Testing of the system

3.6.2.8.1 After fitting on board, piping of the system shall be pressure tested with the test pressure as follows:

.1 pipelines from directional valves to protected spaces and pipelines from safety valves, passing through accommodation and service spaces – 5.0 MPa;

.2 pipelines in transit through spaces other than accommodation and service spaces and pipelines in the protected space – 1.0 MPa;

.3 remote control pilot line piping, from pilot cylinders to directional valves/ cylinder valves – 1.3 working pressure by compressed nitrogen.

3.6.2.8.2 When the system has been installed, pressure-tested and inspected, the following shall be carried out:

.1 a test of the free flow in all pipes and nozzles with the use of compressed air or nitrogen; and

.2 a functional test of the alarm equipment. (FSS Code, Ch. 5/2.2.3)

The guidelines for periodical inspections and tests of the CO_2 system are given in MSC.1/ Circ.1318/Rev.1.

3.6.2.9 Low-pressure CO_2 system

Where a low pressure CO_2 system is fitted, additionally to the applicable requirements given in sec. 3.6.2.1 to 3.6.2.8, the following applies.

3.6.2.9.1 The system control devices and the refrigerating plants shall be located within the same room where the pressure vessels are stored. (FSS Code, Ch. 5/2.2.4.1)

3.6.2.9.2 The rated amount of liquid carbon dioxide shall be stored in vessel(s) under the working pressure in the range of 1.8 N/mm^2 to 2.2 N/mm^2. The normal liquid charge in the container shall be limited to provide sufficient vapour space to allow for expansion of the liquid under the maximum storage temperatures than can be obtained corresponding to the setting of the pressure relief valves but shall not exceed 95% of the volumetric capacity of the container. (FSS Code, Ch. 5/2.2.4.2)

3.6.2.9.3 On pressure vessels, provision shall be made for:

.1 pressure gauge;
.2 high pressure alarm: not more than setting of the relief valve;
.3 low pressure alarm: not less than 1.8 N/mm^2;
.4 branch pipes with stop valves for filling the vessel;
.5 discharge pipes;
.6 liquid CO_2 level indicator, fitted on the vessel(s);
.7 two safety valves. (FSS Code, Ch. 5/2.2.4.3)

3.6.2.9.4 The two safety relief valves shall be arranged so that either valve can be shut off while the other is connected to the vessel. The setting of the relief valves shall not be less than 1.1 times 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 open. (FSS Code, Ch. 5/2.2.4.4)

3.6.2.9.5 The vessel(s) and outgoing pipes permanently filled with carbon dioxide shall have thermal insulation preventing the operation of the safety 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 refrigeration unit. (FSS Code, Ch. 5/2.2.4.5)

The insulating materials of the vessel and their external surface coating should have adequate mechanical properties, fire resistance and protection against water vapor penetration – subject to PRS approval.

3.6.2.9.6 The vessel(s) shall be serviced by two automated completely independent refrigerating units solely intended for this purpose, each comprising a compressor and the relevant prime mover, evaporator and condenser. (FSS Code, Ch. 5/2.2.4.6)

In the event of failure of either one of the refrigerating units, the second shall be actuated automatically. Provision shall be made for local manual control of the refrigerating unit.

3.6.2.9.7 The refrigerating capacity and the 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 air temperatures up to 45°C. (FSS Code, Ch. 5/2.2.4.7)

3.6.2.9.8 Each electric refrigerating unit shall be supplied from the main switchboard busbars by a separate feeder. (FSS Code, Ch. 5/2.2.4.8)

3.6.2.9.9 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. (FSS Code, Ch. 5/2.2.4.9)

3.6.2.9.10 Safety relief devices shall be provided in each section of pipe that may be isolated by block valves and in which there could be a build-up of pressure in excess of the design pressure of any of the components. (FSS Code, Ch. 5/2.2.4.10)

3.6.2.9.11 Audible and visual alarms shall be given in a central control station or, in accordance with *Part VIII* (SOLAS reg. II-1/51), where a central control station is not provided, when:

- **.1** the pressure in the vessel(s) reaches the low and high values according to par. 3.6.2.9.2 (FSS Code, par.2.2.4.2);
- **.2** any one of the refrigerating units fails to operate; or
- **.3** the lowest permissible level of the liquid in the vessels is reached. (FSS Code, Ch. 5/2.2.4.11)

3.6.2.9.12 If the system serves more than one space, means for control of discharge quantities of CO_2 shall be provided, e.g. automatic timer or accurate level indicators located at the control position(s). (FSS Code, Ch. 5/2.2.4.12)

3.6.2.9.13 If a device is provided which automatically regulates the discharge of the rated quantity of carbon dioxide into the protected spaces, it shall be also possible to regulate the discharge manually. (FSS Code, Ch. 5/2.2.4.13)

3.6.2.9.14 The piping system is to be designed in such a way that the CO_2 pressure at the nozzles should not be less than 1 MPa (N/mm^2). (IACS UR F46)

3.6.2.9.15 Pipe connections shall be provided on the open deck on the port and starboard side for filling CO_2 vessels. The filling lines should be equipped with valves that allow for pressure equalization when filling the CO_2 vessel.

3.6.2.9.16 After fitting on board, piping of the system shall be pressure tested with the test pressure as follows:

- **.1** pipelines from the pressure vessels to directional valves – 1.5 max vessel pressure;
- **.2** pipelines from directional valves to protected spaces and pipelines from safety valves, passing through accommodation and service spaces – 1.25 max vessel pressure;
- **.3** pipelines in transit through spaces other than accommodation and service spaces and pipelines in the protected space – 1.0 MPa;
- **.4** remote control pilot line piping, from pilot cylinders to directional valves (if fitted) – 1.3 working pressure by compressed nitrogen.

3.6.2.9.17 After completion on board, the system is subject to acceptance and tests in accordance with the approved test program. In addition to the tests required in par. 3.6.2.8.2, the scope of the tests shall include the operation tests of the refrigerating plants.

3.6.2.10 Steam fire-extinguishing systems

3.6.2.10.1 The use of steam as a fire-extinguishing medium in fixed fire-extinguishing systems required by the present *Part V* is not permitted. Steam fire-extinguishing system may be used only in restricted areas as an addition to the required fixed fire-extinguishing systems.

3.6.2.10.2 The boiler or boilers available for supplying steam shall have an evaporation of at least 1 kg of steam per hour for each 0.75 m^3 of the gross volume of the largest space so protected. In addition to complying with the foregoing requirements, the systems in all respects shall be as determined by, and to the satisfaction of, the Administration. (FSS Code, Ch. 5/2.2.4.13)

3.6.2.10.3 During normal operation of the ship, the boiler shall ensure continuous steam supply to the system with the required capacity.

3.6.3 Equivalent fixed gas fire-extinguishing systems for machinery spaces and cargo pump-rooms

3.6.3.1 General

3.6.3.1.1 Below guidelines are based on MSC/Circ.848, as amended by MSC.1/Circ.1267 and MSC.1/Circ.1316. PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.6.3.1.2 Fixed gas fire-extinguishing systems for use in machinery spaces of category A and cargo pump-rooms equivalent to fire-extinguishing systems required by sec. 3.6.2 (SOLAS reg. II-2/10.4 and II-2/10.9) should prove that they have the same reliability which has been identified as significant for the performance of fixed gas fire-extinguishing systems approved under the requirements of sec. 3.6.2 (FSS Code, Ch. 5). (MSC/Circ.848, An. Par.1)

3.6.3.1.3 Fixed gas fire-extinguishing systems (e.g. FM-200, NOVEC, FE-36, etc.), equivalent to those specified in sec. 3.6.2 (FSS Code, Ch. 5, par. 2.2 and 2.3) shall be approved by the Administration based on the guidelines developed by Organization.* (FSS Code, Ch. 5/2.4)

* Refer to the *Revised guidelines for the approval of equivalent fixed gas fire extinguishing systems, as referred to in SOLAS 74, for machinery spaces and cargo pump rooms* (MSC/Circ.848, as amended by MSC.1/Circ.1267).

3.6.3.2 Definitions

For the purposes of this section 3.6.3, the following definitions apply:

.1 ***Adverse physiological or toxicological effects*** are considered to be evidence of cardiac sensitization, for the purposes of approving halocarbon fire-extinguishing agents in accordance with MSC/Circ.848 and MSC.1/Circ.1267. (MSC.1/Circ.1316, An. par. 2.1)

.2 ***Halocarbon agent*** is a fire-extinguishing medium consisting of one or more carbon atoms linked to one or more Halogen atoms from the elements bromine, chlorine, fluorine and iodine. (MSC.1/Circ.1316, An. par. 2.2)

.3 ***NOAEL*** is the highest concentration at which no adverse physiological or toxicological effect has been observed. (MSC.1/Circ.1316, An. par. 2.3)

.4 ***LOAEL*** is the lowest concentration at which an adverse physiological or toxicological effect has been observed. (MSC.1/Circ.1316, An. par. 2.4)

3.6.3.3 Principal requirements

3.6.3.3.1 All requirements of sec. 3.6.1 (the FSS Code, Ch. 5, reg. 2.1), except as modified by these sub-chapter, should apply. (MSC/Circ.848, An. par. 2, MSC.1/Circ.1267)

3.6.3.3.2 The minimum extinguishing concentration should be determined by a cup burner test acceptable to the Administration. The design concentration should be at least 30% above the minimum extinguishing concentration. These concentrations should be verified by full-scale testing described in the test method, as set out in the appendix of MSC/Circ.848, as amended. (MSC/Circ.848, An. par 3, MSC.1/Circ.1267)

3.6.3.3.3 For systems using halocarbon clean agents, 95% of the design concentration should be discharged in 10 s or less. For inert gas systems, the discharge time should not exceed 120 s for 85% of the design concentration. (MSC/Circ.848, An. par. 4)

3.6.3.3.4 The quantity of extinguishing agent for the protected space should be calculated at the minimum expected ambient temperature using the design concentration based on the net volume of the protected space, including the casing. (MSC/Circ.848, An. par. 5)

3.6.3.3.4.1 The net volume of a protected space is that part of the gross volume of the space which is accessible to the free extinguishing agent gas. (MSC/Circ.848, An. par. 5.1)

3.6.3.3.4.2 When calculating the net volume of a protected space, the net volume should include the volume of the bilge, the volume of the casing and the volume of free air contained in air receivers that in the event of a fire is released into the protected space. (MSC/Circ.848, An. par. 5.2)

3.6.3.3.4.3 The objects that occupy volume in the protected space should be subtracted from the gross volume of the space. They include, but are not necessarily limited to:
- auxiliary machinery;
- boilers;
- condensers;
- evaporators;
- main engines;
- reduction gears;
- tanks; and
- trunks. (MSC/Circ.848, An. par. 5.3)

3.6.3.3.4.4 Subsequent modifications to the protected space that alter the net volume of the space shall require the quantity of extinguishing agent to be adjusted to meet the requirements of this paragraph and par. 3.6.3.3.5. (MSC/Circ.848, An. par. 5.4)

3.6.3.3.5 All systems should be designed to allow evacuation of the protected spaces prior to discharge. Means should also be provided for automatically giving audible and visual warning of the release of fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarm should operate for the period of time necessary to evacuate the space, but not less than 20 s before the medium is released. Unnecessary exposure, even at concentrations below an adverse effect level, should be avoided. (MSC.1/Circ.1267, An. par. 6)

3.6.3.3.5.1 Even at concentrations below an adverse effect level, exposure to gaseous fire extinguishing agents should not exceed 5 min Halocarbon agents may be used up to the No Observed Adverse Effect Level (NOAEL) calculated on the net volume of the protected space at the maximum expected ambient temperature without additional safety measures. If a halocarbon agent is to be used above its NOAEL, means should be provided to limit exposure to no longer than the time specified according to a scientifically accepted physiologically based pharmacokinetic* (PBPK) model or its equivalent which clearly establishes safe exposure limits both in terms of extinguishing media concentration and human exposure time. (MSC.1/Circ.1267, An. par. 6.1)

* Refer to document FP 44/INF.2 - *Physiologically based pharmacokinetic model to establish safe exposure criteria for halocarbon fire extinguishing agents.*

3.6.3.3.5.2 For inert gas systems, means should be provided to limit exposure to no longer than 5 min for inert gas systems designed to concentrations below 43% (corresponding to an oxygen concentration of 12%, sea level equivalent of oxygen) or to limit exposure to no longer than 3 min for inert gas systems designed to concentrations between 43% and 52% (corresponding to between 12% and 10% oxygen, sea level equivalent of oxygen) calculated on the net volume of the protected space at the maximum expected ambient temperature. (MSC.1/Circ.1267, An.6.2)

3.6.3.3.5.3 In no case should a halocarbon agent be used at concentrations above the Lowest Observed Adverse Effect Level (LOAEL) nor the Approximate Lethal Concentration (ALC) nor should an inert gas be used at gas concentrations above 52% calculated on the net volume of the protected space at the maximum expected ambient temperature. (MSC.1/Circ.1267, An. par. 6.3)

3.6.3.3.5.4 The NOAEL and LOAEL values for halocarbon agents listed in the National Fire Protection Association Standard (NFPA) 2001 are acceptable as meeting these Guidelines without further testing. For halocarbon agents not listed in NFPA 2001, cardiac sensitization testing in accordance with section 4 of MSC.1/Circ.1316 should be performed to determine the NOAEL and LOAEL values. (MSC.1/Circ.1316, An. par. 3.1)

3.6.3.3.6 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging, and corrosion normally encountered in machinery spaces or cargo pump-rooms in ships. (MSC/Circ.848, An. par. 7)

3.6.3.3.7 The system and its components should be designed and installed in accordance with international standards acceptable to Organization* and manufactured and tested to the satisfaction of the Administration. As a minimum, the design and installation standards should cover the following elements:

.1 safety:
- toxicity;
- noise, nozzle discharge; and
- decomposition products;

.2 storage container design and arrangement:
- strength requirements;
- maximum/minimum fill density, operating temperature range;
- pressure and weight indication;
- pressure relief; and
- agent identification and lethal requirements;

.3 agent supply, quantity, quality standards;

.4 pipe and fittings:
- strength, material, properties, fire resistance; and
- cleaning requirements;

.5 valves:
- testing requirements;
- corrosion resistance; and
- elastomer compatibility;

.6 nozzles:
- height and area testing requirements; and
- corrosion and elevated temperature resistance;

.7 actuation and control systems:

- testing requirements; and
- backup power requirements;

.8 alarms and indicators:
- predischarge alarm, agent discharge alarms as time delays;
- abort switches;
- supervisory circuit requirements; and
- warning signs and audible and visual alarms should be located outside each entry to the relevant space as appropriate;

.9 agent flow calculation:
- approval and testing of design calculation method; and
- fitting losses and/or equivalent length;

.10 enclosure integrity and leakage requirements:
- enclosure leakage;
- openings; and
- mechanical ventilation interlocks;

.11 design concentration requirements, total flooding quantity;
.12 discharge time; and
.13 inspection, maintenance, and testing requirements. (MSC/Circ.848, An. par. 8)

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* Until international standards are developed, national standards acceptable to the Administration should be used. Available national standards include, e.g., Standards of Australia, the United Kingdom and NFPA 2001.

3.6.3.3.8 The nozzle type, maximum nozzle spacing, maximum height and minimum nozzle pressure should be within limits tested to provide fire extinction per the proposed test method. (MSC/Circ.848, An. par. 9)

3.6.3.3.9 Provisions should be made to ensure that escape routes which are exposed to leakage from the protected space are not rendered hazardous during or after discharge of the agent in the event of a fire. In particular, hydrogen fluoride (HF) vapour can be produced in fires as a breakdown product of the fluorocarbon fire extinguishing agents and cause health effects such as upper respiratory tract and eye irritation to the point of impairing escape. Control stations and other locations that require manning during a fire situation should have provisions to keep HF and HCl below 5 ppm at that location. The concentrations of other products should be kept below concentrations considered hazardous for the required duration of exposure. (MSC.1/Circ.1267, An. par. 10)

3.6.3.3.10 Where agent containers are stored within a protected space*, the containers should be evenly distributed throughout the space and meet the following provisions:

.1 a manually initiated power release, located outside the protected space, should be provided. Duplicate sources of power should be provided for this release and should be located outside the protected space, and be immediately available;

.2 electric power circuits connecting the containers should be monitored for fault conditions and loss of power. Visual and audible alarms should be provided to indicate this;

.3 pneumatic, electric or hydraulic power circuits connecting the containers should be duplicated and widely separated. The sources of pneumatic or hydraulic pressure should be monitored for loss of pressure. Visual and audible alarms should be provided to indicate this;

.4 within the protected space, electrical circuits essential for the release of the system should be fire resistant according to standard IEC 60331 or other equivalent standards. Piping systems essential for the release of systems designed to be operated hydraulically or pneumatically should be of steel or other equivalent heat-resisting material to the satisfaction of the Administration;

.5 each pressure container should be fitted with an automatic overpressure release device which, in the event of the container being exposed to the effects of fire and the system not being operated, will safely vent the contents of the container into the protected space;

.6 the arrangement of containers and the electrical circuits and piping essential for the release of any system should be such that in the event of damage to any one power release line or container valve through mechanical damage, fire or explosion in a protected space, i.e. a single fault concept, at least the amount of agent needed to achieve the minimum extinguishing concentration can still be discharged having regard to the requirement for uniform distribution of medium throughout the space; and

.7 the containers should be monitored for decrease in pressure due to leakage and discharge. Visual and audible alarms in the protected area and on the navigation bridge or in the space where the fire control equipment is centralized should be provided to indicate this condition. (MSC.1/Circ.1267, An. par. 11)

.8 locations of extinguishing agent cylinders should be indicated with the symbol used in the *Fire Control Plan*.

*** *IACS interpretation***

Agent containers stored in a protected space shall be distributed throughout the space with bottles or groups of bottles located in at least six separate locations. Duplicate power release lines shall be arranged to release all bottles simultaneously. The release lines shall be so arranged that in the event of damage to any power release line, five sixth of the fire extinguishing gas can still be discharged. The bottle valves are considered to be part of the release lines and a single failure shall include also failure of the bottle valve.

For systems that need less than six cylinders (using the smallest bottles available), the total amount of extinguishing gas on the bottles shall be such that in the event of a single failure to one of the release lines (including bottle valve), five sixth of the fire extinguishing gas can still be discharged. This may be achieved by for instance using more extinguishing gas than required so that if one bottle is not discharging due to a single fault, the remaining bottles will discharge the minimum five sixth of the required amount of gas. This can be achieved with minimum two bottles. However, NOAEL values calculated at the highest expected engine room temperature are not to be exceeded when discharging the total amount of extinguishing gas simultaneously.

Systems that can not comply with the above, for instance systems using only one bottle located inside the protected space, cannot be accepted. Such systems shall be designed with the bottle(s) located outside the protected space, in a dedicated room in compliance with par. 3.6.1.6 (SOLAS Reg.II-2/10.4.3). (IACS UI SC200)

3.6.3.3.11 A minimum agent hold time of 15 min should be provided. (MSC/Circ.848, An. par. 12)

3.6.3.3.12 The release of an extinguishing agent may produce significant over and under pressurization in the protected space. Measures to limit the induced pressures to acceptable limits should be provided. (MSC/Circ.848, An. par. 13)

3.6.3.3.13 For all ships, the fire-extinguishing system design manual should address recommended procedures for the control of products of agent decomposition, including HF vapour generated from fluorocarbon extinguishing agents which could impair escape. Clearly, longer exposure of the agent to high temperatures would produce greater concentrations of these types of gases. The type and sensitivity of detection, coupled with the rate of discharge, should be selected to minimize the exposure time of the agent to the elevated temperature. The performance of fire-extinguishing arrangements on passenger ships should not present health hazards from decomposed extinguishing agents, for example on passenger ships, the decomposition products should not be discharged in the vicinity of muster (assembly) stations. Other mitigating steps include evacuation, and donning masks. (MSC.1/Circ.1267, An. par. 14)

3.6.3.4 Tests of the system after installation on board

3.6.3.4.1 After fitting on board, all piping of the system should be pressure tested with the test pressure at least 1.25 working pressure.

3.6.3.4.2 After installation on board, the system is subject to functional tests, based on agreed acceptance and test program.

3.6.4 Fixed aerosol fire-extinguishing system for machinery spaces

3.6.4.1 General

3.6.4.1.1 Below guidelines are based on MSC.1/Circ.1270/Corr.1 and MSC.1/Circ.1316. PRS will enforce these provisions as mandatory if so decided by the flag State Administration and also as a part of classification supervision in case when at the construction stage the ship's flag is not known.

3.6.4.1.2 Fixed aerosol fire-extinguishing system is intended for the protection of machinery spaces of category A as equivalent to gas systems required by sec. 3.6.2 (SOLAS reg. II-2/10.5) (MSC.1/Circ.1270/Corr.1, An. par. 1)

3.6.4.1.3 Aerosol fire-extinguishing systems involve the release of a chemical agent to extinguish a fire by interruption of the process of the fire.

There are two methods considered for applying the aerosol agent to the protected space:

- **.1** condensed aerosols are created in pyrotechnical generators through the combustion of the agent charge; and
- **.2** dispersed aerosols that are not pyrotechnically generated and are stored in containers with carrier agents (such as inert gases or halocarbon agents) with the aerosol released in the space through valves, pipes and nozzles. (MSC.1/Circ.1270/Corr.1, An. par. 2)

3.6.4.1.4 Fixed aerosol fire-extinguishing systems, equivalent to those specified in sec. 3.6.2 (FSS Code, Ch. 5, par. 2.2 and 2.3) shall be approved by the Administration based on the guidelines developed by Organization.* (FSS Code, Ch. 5/2.4)

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* Refer to the *Guidelines for the approval of fixed aerosol fire-extinguishing systems equivalent to fixed gas fire extinguishing systems, as referred to in SOLAS 74, for machinery spaces* (MSC.1/Circ.1270/Corr.1).

3.6.4.2 Definitions

For the purposes of this section 3.6.4, the following definitions apply:

- **.1** ***Aerosol*** is a fire-extinguishing medium consisting of finely divided solid particles of chemicals released into a protected space as either condensed aerosol or dispersed aerosol. (MSC.1/Circ.1270/Corr.1, An. par. 3)
- **.2** ***Generator*** is a device for creating a fire-extinguishing medium by pyrotechnical means. (MSC.1/Circ.1270/Corr.1, An. par. 4)
- **.3** ***Efficiency coefficient*** is the percentage (%) of aerosol forming composition actually discharged from a specific aerosol generator. It is determined by comparing the mass loss of a generator after discharge to its beginning mass. (MSC.1/Circ.1270/Corr.1, An. par. 5)
- **.4** ***Design application density*** (g/m^3) is the mass of an aerosol forming composition per m^3 of the enclosure volume required to extinguish a specific type of fire, including a safety factor of 1.3 times the test density. (MSC.1/Circ.1270/Corr.1, An. par. 6)

.5 ***Agent – medium*** for the purpose of these guidelines, these words are interchangeable. (MSC.1/Circ.1270/Corr.1, An. par. 7)

3.6.4.3 Principal requirements

3.6.4.3.1 The design application density should be determined and verified by the full-scale testing described in the test method, as set out in appendix 1 of MSC.1/Circ.1270/Corr.1. (MSC.1/Circ.1270/Corr.1, An. par. 8)

3.6.4.3.2 The delivered density for each type of generator should be determined and verified by the test method set out in appendix 2 of MSC.1/Circ.1270/Corr.1. (MSC.1/Circ.1270/Corr.1, An. par. 9)

3.6.4.3.3 The system discharge time should not exceed 120 s. Systems may need to discharge in a shorter time for other reasons than for fire-extinguishing performance. (MSC.1/Circ.1270/Corr.1, An. par. 10)

3.6.4.3.4 The quantity of extinguishing agent for the protected space should be calculated at the minimum expected ambient temperature using the design density based on the net volume of the protected space, including the casing. (MSC.1/Circ.1270/Corr.1, An. par. 11)

3.6.4.3.4.1 The net volume of a protected space is that part of the gross volume of the space, which is accessible to the fire-extinguishing agent. (MSC.1/Circ.1270/Corr.1, An. par. 11.1)

3.6.4.3.4.2 When calculating the net volume of a protected space, the net volume should include the volume of the bilge, the volume of the casing and the volume of free air contained in air receivers that in the event of a fire may be released into the protected space. (MSC.1/Circ.1270/Corr.1, An. par. 11.2)

3.6.4.3.4.3 The objects that occupy volume in the protected space should be subtracted from the gross volume of the space. They include, but are not necessarily limited to:

.1 auxiliary machinery;
.2 boilers;
.3 condensers;
.4 evaporators;
.5 main engines;
.6 reduction gears;
.7 tanks; and
.8 trunks. (MSC.1/Circ.1270/Corr.1, An. par. 11.3)

3.6.4.3.4.4 Subsequent modifications to the protected space that alter the net volume of the space should require the quantity of extinguishing agent to be adjusted to meet the requirements of par. 3.6.4.3.5.2 to 3.6.4.3.5.5 (10.1, 10.2, 10.3, 10.4, 12.2, 12.3, 12.4 and 12.5). (MSC.1/Circ.1270/Corr.1, An. par. 11.4)

3.6.4.3.5 No fire suppression system should be used which is carcinogenic, mutagenic or teratogenic at application densities expected during use. The discharge of aerosol systems to extinguish a fire could create a hazard to personnel from the natural form of the aerosol, or from certain products of aerosol generation (including combustion products and trace gases from condensed aerosols). Other potential hazards that should be considered for individual systems are the following: noise from discharge, turbulence, cold temperature of vaporizing liquid, reduced visibility, potential toxicity, thermal hazard and potential toxicity from the aerosol generators, and eye irritation from direct contact with aerosol particles. Unnecessary exposure to aerosol media, even at concentrations below an adverse effect level, and to their decomposition products should be avoided. All aerosols used in fire-extinguishing systems should have non-ozone depleting characteristics. (MSC.1/Circ.1270/Corr.1, An. par. 12)

3.6.4.3.5.1 All systems should be designed to allow evacuation of the protected spaces prior to discharge through the use of two separate controls for releasing the extinguishing medium. Means should also be provided for automatically giving visual and audible warning of the release of fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarms should operate for the period of time necessary to evacuate the space, but not less than 20 s before the medium is released. (MSC.1/Circ.1270/Corr.1, An. par. 12.1)

3.6.4.3.5.2 Condensed aerosol systems for spaces that are normally occupied should be permitted in concentrations where the aerosol particulate density does not exceed the adverse effect level as determined by a scientifically accepted technique * and any combustion products and trace gases produced by the aerosol generating reaction do not exceed the appropriate excursion limit for the critical toxic effect as determined in acute inhalation toxicity tests. (MSC.1/Circ.1270/Corr.1, An. par. 12.2)

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* Reference is made to the United States' EPAs Regional Deposited Dose Ratio Program *"Methods of Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry"* EPA/600/8-90/066F. October 1994.

3.6.4.3.5.3 Dispersed aerosol systems for spaces that are normally occupied should be permitted in concentrations where the aerosol particulate density does not exceed the adverse effect level as determined by a scientifically accepted technique. Even at concentrations below an adverse affect level, exposure to extinguishing agents should not exceed 5 min. If the carrier gas is a halocarbon, it may be used up to its No Observed Adverse Affect Level (NOAEL) calculated on the net volume of the protected space at the maximum expected ambient temperature without additional safety measures. If a halocarbon carrier gas is to be used above its NOAEL, means should be provided to limit exposure to no longer than the corresponding maximum permitted human exposure time specified according to a scientifically accepted physiologically based pharmacokinetic** (PBPK) model or its equivalent which clearly establishes safe exposure limits both in terms of extinguishing media concentration and human exposure time. (MSC.1/Circ.1270/Corr.1, An. par. 12.3)

** Refer to document FP 44/INF.2 (United States) – *Physiologically based pharmacokinetic model to establish safe exposure criteria for halocarbon fire-extinguishing agents.*

3.6.4.3.5.4 If the carrier is an inert gas, means should be provided to limit exposure to no longer than 5 min for inert gas systems designed to concentrations below 43% (corresponding to an oxygen concentration of 12%, sea level equivalent of oxygen) or to limit exposure to no longer than 3 min for inert gas systems designed to concentrations between 43% and 52% (corresponding to between 12% and 10% oxygen, sea level equivalent of oxygen) calculated on the net volume of the protected space at the maximum expected ambient temperature. (MSC.1/Circ.1270/Corr.1, An. par. 12.4)

3.6.4.3.5.5 In no case should a dispersed aerosol system be used with halocarbon carrier gas concentrations above the Lowest Observed Adverse Effect Level (LOAEL) nor the Approximate Lethal Concentration (ALC) nor should a dispersed aerosol system be used with an inert gas carrier at gas concentrations above 52% calculated on the net volume of the protected space at the maximum expected ambient temperature. (MSC.1/Circ.1270/Corr.1, An. par. 12.5)

3.6.4.3.5.5.1 The NOAEL and LOAEL values for halocarbon agents listed in the National Fire Protection Association Standard (NFPA) 2001 are acceptable as meeting these Guidelines without further testing. For halocarbon agents not listed in NFPA 2001, cardiac sensitization testing in accordance with section 4 of MSC.1/Circ.1316 should be performed to determine the NOAEL and LOAEL values. (MSC.1/Circ.1316, An. par. 3.1)

3.6.4.3.6 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging, electromagnetic compatibility and corrosion normally encountered in machinery spaces. Generators in condensed aerosol systems should be designed to prevent self-activation at a temperature below 250°C. (MSC.1/Circ.1270/Corr.1, An. par. 13)

3.6.4.3.7 The system and its components should be designed, manufactured and installed in accordance with standards acceptable to Organization. As a minimum, the design and installation standards should cover the following elements:

.1 safety:
- toxicity;
- noise, nozzle discharge; and
- decomposition products;
- obscuration; and
- minimum safe distance required between generators and escape routes and combustible materials;

.2 storage container design and arrangement:
- strength requirements;
- maximum/minimum fill density, operating temperature range;
- pressure and weight indication;
- pressure relief; and
- agent identification and lethal requirements;

.3 agent supply, quantity, quality standards, shelf life and service life of agent and igniter;

.4 handling and disposal of generator after service life;

.5 pipe and fittings:
- strength, material, properties, fire resistance; and
- cleaning requirements;

.6 valves:
- testing requirements; and
- elastomer compatibility;

.7 generators/nozzles:
- height and area testing requirements;
- elevated temperature resistance; and
- mounting location requirements considering safe distances to escape routes and combustible materials;

.8 actuation and control systems:
- testing requirements; and
- backup power requirements;

.9 alarms and indicators:
- predischarge alarm, agent discharge alarms as time delays;
- supervisory circuit requirements;
- warning signs, audible and visual alarms; and
- annunciation of faults;

.10 enclosure integrity and leakage requirements:

- enclosure leakage;
- openings; and
- mechanical ventilation interlocks;

.11 electrical circuits for pyrotechnic generators:
- requirements for mounting and protection of cables;

.12 design density requirements, total flooding quantity;

.13 agent flow calculation:
- verification and approval of design calculation method;
- fitting losses and/or equivalent length; and
- discharge time;

.14 inspection, maintenance, service and testing requirements; and

.15 handling and storage requirements for pyrotechnical components. (MSC.1/Circ.1270/Corr.1, An. par. 14)

3.6.4.3.8 The generator/nozzle type, maximum generator/nozzle spacing, maximum generator/nozzle installation height and minimum generator/nozzle pressure should be within limits tested. (MSC.1/Circ.1270/Corr.1, An. par. 15)

3.6.4.3.9 Installations should be limited to the maximum volume tested. (MSC.1/Circ.1270/Corr.1, An. par. 16)

3.6.4.3.10 Where agent containers are stored within a protected space*, the containers should be evenly distributed throughout the space and meet the following provisions:

.1 a manually initiated power release, located outside the protected space, should be provided. Duplicate sources of power should be provided for this release and should be located outside the protected space and be immediately available;

.2 electric power circuits connecting the generators should be monitored for fault conditions and loss of power. Visual and audible alarms should be provided to indicate this;

.3 pneumatic, electric or hydraulic power circuits connecting the generators should be duplicated and widely separated. The sources of pneumatic or hydraulic pressure should be monitored for loss of pressure. Visual and audible alarms should be provided to indicate this;

.4 within the protected space, electrical circuits essential for the release of the system should be fire resistant according to standard IEC 60331 or equivalent standards. Piping systems essential for the release of systems designed to be operated hydraulically or pneumatically should be of steel or other equivalent heat-resisting material to the satisfaction of the Administration;

.5 each dispersed aerosol pressure container should be fitted with an automatic overpressure release device which, in the event of the container being exposed to the effects of fire and the system not being operated, will safely vent the contents of the container into the protected space;

.6 the arrangement of generators and the electrical circuits and piping essential for the release of any system should be such that in the event of damage to any one power release line or generator through mechanical damage, fire or explosion in a protected space, i.e., a single fault concept, at least the amount of agent needed to achieve the test density can still be discharged having regard to the requirement for uniform distribution of medium throughout the space; and

.7 dispersed aerosol containers should be monitored for decrease in pressure due to leakage and discharge. Visual and audible alarms in the protected area and on the navigation bridge, in the onboard safety centre or in the space where the fire control equipment is centralized should be provided to indicate this condition. (MSC.1/Circ.1270/Corr.1, An. par. 17)

.8 location of aerosol containers/ generators should be indicated with the symbol used in the *Fire Control Plan*.

*** IACS interpretation**

Agent containers stored in a protected space shall be distributed throughout the space with bottles or groups of bottles located in at least six separate locations. Duplicate power release lines shall be arranged to release all bottles simultaneously. The release lines shall be so arranged that in the event of damage to any power release line, five sixth of the fire extinguishing gas can still be discharged. The bottle valves are considered to be part of the release lines and a single failure shall include also failure of the bottle valve.

For systems that need less than six cylinders (using the smallest bottles available), the total amount of extinguishing gas on the bottles shall be such that in the event of a single failure to one of the release lines (including bottle valve), five sixth of the fire extinguishing gas can still be discharged. This may be achieved by for instance using more extinguishing gas than required so that if one bottle is not discharging due to a single fault, the remaining bottles will discharge the minimum five sixth of the required amount of gas. This can be achieved with minimum two bottles. However, NOAEL values calculated at the highest expected engine room temperature are not to be exceeded when discharging the total amount of extinguishing gas simultaneously.

Systems that can not comply with the above, for instance systems using only one bottle located inside the protected space, cannot be accepted. Such systems shall be designed with the bottle(s) located outside the protected space, in a dedicated room in compliance with sub-chapter 3.6.1.5 (SOLAS Reg.II-2/10.4.3). (IACS UI SC200)

3.6.4.3.11 The release of an extinguishing agent may produce significant over and under pressurization in the protected space. Constructive measures to limit the induced pressures to acceptable limits may have to be provided. (MSC.1/Circ.1270/Corr.1, An. par. 18)

3.6.4.3.12 For all ships, the fire-extinguishing system design manual should address recommended procedures for the control and disposal of products of agent decomposition. The performance of fire-extinguishing arrangements on passenger ships should not present health hazards from decomposed extinguishing agents, (e.g., on passenger ships, the decomposition products should not be discharged in the vicinity of assembly stations). (MSC.1/Circ.1270/Corr.1, An. par. 19)

3.6.4.3.13 Spare parts and operating and maintenance instructions, including operational tests for the system should be provided as recommended by the manufacturer. (MSC.1/Circ.1270/Corr.1, An. par. 20)

3.6.4.3.14 The temperature profile of the discharge stream from condensed aerosol generators should be measured in accordance with appendix 1 of MSC.1/Circ.1270/Corr.1. This data should be used to establish the minimum safe distances away from the generator where the discharge temperatures do not exceed 75°C and 200°C. (MSC.1/Circ.1270/Corr.1, An. par. 21)

3.6.4.3.15 The casing temperature of condensed aerosol generators should be measured in accordance with appendix 1 of MSC.1/Circ.1270/Corr.1. This data should be used to establish the minimum safe distances away from the generator where the discharge temperatures do not exceed 75°C and 200°C. (MSC.1/Circ.1270/Corr.1, An. par. 22)

3.6.4.3.16 Generators should be separated from escape routes and other areas where personnel may be present by at least the minimum safe distances determined in par. 3.6.4.3.14 and 3.6.4.3.15 (21 and 22) above for exposure to 75°C. (MSC.1/Circ.1270/Corr.1, An. par. 23)

3.6.4.3.17 Generators should be separated from combustible materials by at least the minimum safe distances determined in par. 3.6.4.3.14 and 3.6.4.3.15 (21 and 22) above for exposure to 200°C. (MSC.1/Circ.1270/Corr.1, An. par. 24)

3.6.4.3.18 The useful life of condensed aerosol generators should be determined by the manufacturer for the temperature range and conditions likely to be encountered on board ships. Generators should be replaced before the end of their useful life. Each generator should be permanently marked with the date of manufacture and the date of mandatory replacement. (MSC.1/Circ.1270/Corr.1, An. par. 25)

3.6.4.4 Test of the system after installation on board

After installation on board, the system is subject to functional tests based on agreed acceptance and test program.

CHAPTER 4

4 FIRE SIGNALLING SYSTEMS

4.1 Fixed fire detection and fire alarm systems

4.1.1 Application

This sub-chapter 4.1 (chapter) details the specification of fixed fire detection and fire alarm systems as required by this *Part V* (chapter II-2 of SOLAS Conv.). (FSS Code, Ch. 9/1.1)

4.1.2 Definitions

For the purposes of this sub-chapter 4.1, the following definitions apply:

.1 ***Section*** – means a group of fire detectors and manually operated call points as reported in the indicating unit(s).

.2 ***Section identification capability*** – means a system with the capability of identifying the section in which a detector or manually operated call point has activated.

.3 ***Individually identifiable*** – means a system with the capability to identify the exact location and type of detector or manually activated call point which has activated, and which can differentiate the signal of that device from all others. (FSS Code, Ch. 9/1.2)

4.1.3 General requirements

4.1.3.1 A fixed fire detection and fire alarm system shall be of an approved type. (SOLAS II-2/7.2.2)

4.1.3.2 Any required fixed fire detection and fire alarm system with manually operated call points shall be capable of immediate operation at all times (this does not require a backup control panel). Notwithstanding this, particular spaces may be disconnected, for example, workshops during hot work and ro-ro spaces during on and off-loading. The means for disconnecting the detectors shall be designed to automatically restore the system to normal surveillance after a predetermined time that is appropriate for the operation in question. The space shall be manned or provided with a fire patrol when detectors required by regulation are disconnected. Detectors in all other spaces shall remain operational. (FSS Code, Ch. 9/2.1.1)

4.1.3.3 Where a fixed fire detection and fire alarm system is required for the protection of spaces other than stairway enclosures, corridors and means of escape, at least one detector shall be installed in each such space. (SOLAS II-2/7.2.3)

4.1.3.4 Manually operated call points* shall be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point shall be located at each exit. Manually operated call points shall be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m from a manually operated call point. (SOLAS II-2/7.7)

Location of each manually operated call point should be marked with the symbol used on *Fire Control Plan*.

*** *IACS interpretation***

It is not required the fitting of a manually operated call point in an individual space within the accommodation spaces, service spaces and control stations. However, a manually operated call point shall be located at each exit (inside or outside) to the open deck 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. A manually operated call point is not required to be installed for spaces having little or no fire risk, such as voids and carbon dioxide rooms, nor at each exit from the navigation bridge, in cases where the control panel is located in the navigation bridge. (IACS UI SC241)

4.1.3.5 The fire detection system shall be designed to:

.1 control and monitor input signals from all connected fire and smoke detectors and manual call points;

.2 provide output signals to the navigation bridge, continuously manned central control station or onboard safety centre to notify the crew of fire and fault conditions;

.3 monitor power supplies and circuits necessary for the operation of the system for loss of power and fault conditions; and

.4 the system may be arranged with output signals to other fire safety systems including:

- **.1** paging systems, fire alarm or public address systems;
- **.2** fan stops;
- **.3** fire doors*;
- **.4** fire dampers;
- **.5** sprinkler systems;
- **.6** smoke extraction systems;
- **.7** low-location lighting systems;
- **.8** fixed local application fire-extinguishing systems;
- **.9** closed circuit television (CCTV) systems; and
- **.10** other fire safety systems. (FSS Code, Ch. 9/2.1.2)

**** IACS interpretation***

Watertight doors complying with SOLAS Reg. II-1/16 which also serve as fire doors are not to close automatically in case of fire detection. (IACS UI SC147)

4.1.3.6 The fire detection system may be connected to a decision management system provided that:

.1 the decision management system is proven to be compatible with the fire detection system;

.2 the decision management system can be disconnected without losing any of the functions required by this sub-chapter 4.1 (chapter) for the fire detection system; and

.3 any malfunction of the interfaced and connected equipment should not propagate under any circumstance to the fire detection system. (FSS Code, Ch. 9/2.1.3)

4.1.3.7 Detectors and manual 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 in separate sections. (FSS Code, Ch. 9/2.1.4)

4.1.3.8 The system and equipment shall be suitably designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships. All electrical and electronic equipment on the bridge or in the vicinity of the bridge shall be tested for electromagnetic compatibility, taking into account the recommendations developed by the Organization*. (FSS Code, Ch. 9/2.1.5)

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* Refer to the *General requirements for electromagnetic compatibility for all electrical and electronic equipment*, adopted by IMO resolution A.813(19).

4.1.3.9 Fixed fire detection and fire alarm systems with individually identifiable fire detectors 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 section will not prevent the continued individual identification of the remainder of the connected detectors in the section;
- **.2** all arrangements are made to enable the initial configuration of the system to be restored in the event of failure (e.g., electrical, electronic, informatics, etc.);
- **.3** the first initiated fire alarm will not prevent any other detector from initiating further fire alarms; and
- **.4** no section will pass through a space twice. When this is not practical (e.g., for large public spaces), the part of the section which by necessity passes through the space for a second time shall be installed at the maximum possible distance from the other parts of the section. (FSS Code, Ch. 9/2.1.6)

4.1.3.10 In cargo ships (…) the fixed fire detection and fire alarm system shall, as a minimum, have section identification capability. (FSS Code, Ch. 9/2.1.7)

4.1.3.11 In cargo ships (…), where an individually identifiable system is fitted, notwithstanding the provisions in par. 4.1.3.9.1 (FSS Code, paragraph 2.1.6.1), isolator modules need not be provided at each fire detector if the system is arranged in such a way that the number and location of individually identifiable fire detectors rendered ineffective due to a fault would not be larger than an equivalent section in a section identifiable system, arranged in accordance with par. 4.1.6.1 (FSS Code, paragraph 2.4.1). (FSS Code, Ch. 9/2.1.8)

4.1.3.12 Spaces/ group of spaces covered by the fixed fire detection and alarm system should be marked by a plate at entrance door with the symbol used on *Fire Control Plan*.

4.1.4 Sources of power supply

4.1.4.1 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 of power. The supply shall be provided by separate feeders reserved solely for that purpose. Such feeders shall run to an automatic change-over switch situated in or adjacent to the control panel for the fire detection system. The changeover switch shall be arranged such that a fault will not result in the loss of both power supplies. The main (respective emergency) feeder shall run from the main (respective emergency) switchboard to the change-over switch without passing through any other distributing switchboard. (FSS Code, Ch. 9/2.2.1)

4.1.4.2 The operation of the automatic changeover switch or a failure of one of the power supplies shall not result in 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. (FSS Code, Ch. 9/2.2.2)

4.1.4.3 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. (FSS Code, Ch. 9/2.2.3)

4.1.4.4 The emergency source of power specified in par. 4.1.4.1 (FSS Code, paragraph 2.2.1) above may be supplied by accumulator batteries or from the emergency switchboard. The power source shall be sufficient to maintain the operation of the fire detection and fire alarm system for the periods required in *Part VIII* for cargo or passenger ships, accordingly (under SOLAS reg. II-1/42 and 43) 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*. (FSS Code, Ch. 9/2.2.4)

*** IMO interpretation**

"30 min" means the last 30 minutes of required periods (18 hours for cargo ships and 36 hours for passenger ships). (MSC.1/Circ.1554)

4.1.4.5 Where the system is supplied from accumulator batteries, they 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. (FSS Code, Ch. 9/2.2.5)

4.1.5 Component requirements

4.1.5.1 Detectors

4.1.5.1.1 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 considered, provided that they are no less sensitive than such detectors. (FSS Code, Ch. 9/2.3.1.1)

4.1.5.1.2 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 standards EN 54:2001 and IEC 60092-504. Alternative testing standards may be used as determined by the Administration. Smoke detectors to be installed in other spaces shall operate within sensitivity limits to the satisfaction of the Administration having regard to the avoidance of detector insensitivity or oversensitivity. (FSS Code, Ch. 9/2.3.1.2)

4.1.5.1.3 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 standards EN 54:2001 and IEC 60092-504. Alternative testing standards may be used as determined by the Administration. At higher rates of temperature rise, the heat detector shall operate within temperature limits to the satisfaction of the Administration having regard to the avoidance of detector insensitivity or oversensitivity. (FSS Code, Ch. 9/2.3.1.3)

4.1.5.1.4 The operation temperature of heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 130°C, and up to 140°C in saunas. (FSS Code, Ch. 9/2.3.1.4)

4.1.5.1.5 Flame detectors shall be tested according to standards EN 54-10:2001 and IEC 60092-504. Alternative testing standards may be used as determined by the Administration. (FSS Code, Ch. 9/2.3.1.5)

4.1.5.1.6 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. (FSS Code, Ch. 9/2.3.1.6)

4.1.5.1.7 Detectors fitted in hazardous areas shall be tested and approved for such service. Detectors required in sec.11.3.1.3 (by SOLAS reg. II-2/20.4) and installed in ro-ro and special category spaces that comply with par. 11.3.1.2.2.2 (SOLAS reg. II-2/20.3.2.2) need not be suitable for hazardous areas. Detectors fitted in spaces carrying dangerous goods, required by chapter 7 (SOLAS reg. II-2/19, table 19.3) to comply with par.7.2.2 (SOLAS reg. II-2/19.3.2), shall be suitable for hazardous areas. (FSS Code, Ch. 9/2.3.1.8)

4.1.5.1.8 Spare detectors and tools necessary for their replacement shall be provided on the ship. The required minimum number of detectors should correspond to 5% of the detectors number for each type used, and should be not less than 2 pcs.

4.1.5.2 Control panel

The control panel for the fire detection system shall be tested according to standards EN 54-2:1997, EN 54-4:1997 and IEC 60092-504:2001. Alternative standards may be used as determined by the Administration. (FSS Code, Ch. 9/2.3.2)

4.1.5.3 Cables

Cables used in the electrical circuits shall be flame retardant according to standard IEC 60332-1. (FSS Code, Ch. 9/2.3.3)

4.1.6 Installation requirements

4.1.6.1 Sections

4.1.6.1.1 Detectors and manually operated call points shall be grouped into sections. (FSS Code, Ch. 9/2.4.1.1)

4.1.6.1.2 A section of fire detectors which covers a control station, a service space or an accommodation space shall not include a machinery space of category A or a ro-ro space. A 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. (FSS Code, Ch. 9/2.4.1.2)

4.1.6.1.3 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 as determined by the Administration. 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. (FSS Code, Ch. 9/2.4.1.3)

4.1.6.2 Positioning of detectors

4.1.6.2.1 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. (FSS Code, Ch. 9/2.4.2.1)

4.1.6.2.2 The maximum spacing of detectors shall be in accordance with the table below:

Table 9.1 – Spacing of detectors

Type of detector	Maximum floor area per detector (m^2)	Maximum distance apart between centres (m)	Maximum distance away from bulkheads (m)
Heat	37	9	4,5
Smoke	74	11	5,5

The Administration may require or permit other spacing based upon test data which demonstrate the characteristics of the detectors. Detectors located below moveable ro-ro decks shall be in accordance with the above. (FSS Code, Ch. 9/2.4.2.2)

4.1.6.2.3 Detectors in stairways shall be located at least at the top level of the stair and at every second level beneath. (FSS Code, Ch. 9/2.4.2.3)

4.1.6.2.4 When fire detectors are installed in freezers, drying rooms, saunas, parts of galleys used to heat food, laundries and other spaces where steam and fumes are produced, heat detectors may be used. (FSS Code, Ch. 9/2.4.2.4)

4.1.6.2.5 Where a fixed fire detection and fire alarm system is required in the area of accommodation and service spaces, (by SOLAS reg. II-2/7.5), spaces having little or no fire risk need not be fitted with detectors. Such spaces include void spaces with no storage of combustibles, private bathrooms, public toilets, fire-extinguishing medium storage rooms, cleaning gear lockers (in which flammable liquids are not stowed), open deck spaces and enclosed promenades having little or no fire risk and that are naturally ventilated by permanent openings. (FSS Code, Ch. 9/2.4.2.5)

4.1.6.3 Arrangement of cables

4.1.6.3.1 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 to the appropriate power supply. (FSS Code, Ch. 9/2.4.3.1)

4.1.6.3.2 A section with individually identifiable capability shall be arranged so that it cannot be damaged at more than one point by a fire. (FSS Code, Ch. 9/2.4.3.2)

4.1.7 System control requirements

4.1.7.1 Visual and audible fire signals*

* Refer to the *Code on Alerts and Indicators, 2009,* as adopted by IMO, resolution A.1021(26).

4.1.7.1.1 The 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. 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.* (FSS Code, Ch. 9/2.5.1.1)

***** *IACS and IMO interpretation***

Power supply to the alarm sounder system when not an integral part of the detection system:

1 *The alarm sounder system utilised by the fixed fire detection and fire alarm system shall be powered from no less than two sources of power, one of which shall be an emergency source of power.*

2 *In vessels required by SOLAS reg. II-1/42 or 43 to be provided with a transitional source of emergency electrical power the alarm sounder system shall also be powered from this power source. (IACS UI SC35, MSC.1/Circ.1487)*

4.1.7.1.2 The control panel shall be located on the navigation bridge or in the fire control station. (FSS Code, Ch. 9/2.5.1.2)

The location of each control panel should be indicated with the symbol used on *Fire Control Plan*.

4.1.7.1.3 In cargo ships, an indicating unit shall be located on the navigation bridge if the control panel is located in the fire control station. In ships (…), with a cargo control room, an additional indicating unit shall be located in the cargo control room*. In cargo ships (…), indicating units shall, as a minimum, denote the section in which a detector has activated or manually operated call point has operated. (FSS Code, Ch. 9/2.5.1.3)

Location of the indicating unit should be marked with symbol used on *Fire Control Plan*.

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*** *IACS and IMO interpretation***

A space in which a cargo control console is installed, but does not serve as a dedicated cargo control room (e.g. ship's office, machinery control room), should be regarded as a cargo control room, and therefore be provided with an additional indicating unit. (IACS UI SC271, MSC.1/Circ.1528)

4.1.7.1.4 Clear information shall be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections. (FSS Code, Ch. 9/2.5.1.4)

4.1.7.1.5 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 to 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. (FSS Code, Ch. 9/2.5.1.5)

4.1.7.1.6 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. (FSS Code, Ch. 9/2.5.1.6)

4.1.7.1.7 The system shall be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared. (FSS Code, Ch. 9/2.5.1.7)

4.1.7.1.8 When the system is required to sound a local audible alarm within the cabins where the detectors are located, a means to silence the local audible alarms from the control panel shall not be permitted. (FSS Code, Ch. 9/2.5.1.8)

4.1.7.1.9 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 should be in the 1/3 octave band about the fundamental frequency. Audible alarm signals shall not exceed 120 dB(A). (FSS Code, Ch. 9/2.5.1.9)

4.1.8 Testing

4.1.8.1 Suitable instructions and component spares for testing and maintenance shall be provided. Detectors shall be periodically tested using equipment suitable for the types of fires to which the detector is designed to respond.

Detectors installed within cold spaces such as refrigerated compartments shall be tested using procedures having due regard for such locations*.

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* Refer to the recommendations of the International Electrical Committee, in particular the publication *IEC 60068-2-1 - Section one - Test Ab, Environmental Testing - Part 2-1: Tests A: Cold.*

Ships with self-diagnostic systems that have in place a cleaning regime for areas where heads may be prone to contamination may carry out testing in accordance with the requirements of the Administration. (FSS Code, Ch. 9/2.5.1.1)

4.1.8.2 After installation on board, the function of fixed fire detection and fire alarm systems shall be tested under varying conditions of ventilation. (SOLAS II-2/7.3.1)

4.2 Sample extraction smoke detection systems

4.2.1 Application

This sub-chapter 4.2 (chapter) details the specification of sample extraction smoke detection systems in cargo spaces as required by this *Part V* (chapter II-2 of the SOLAS Conv.). (FSS Code, Chapter 10/1)

4.2.2 General requirements

4.2.2.1 Wherever in the text of this sub-chapter 4.2 (chapter) the word "system" appears, it shall mean "sample extraction smoke detection system". (FSS Code, Ch. 10/2.1.1)

4.2.2.2 Sample extraction smoke detection system shall be of an approved type. (SOLAS II-2/7.2.2)

4.2.2.3 A sample extraction smoke detection system consists 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 airstream is monitored by electrical smoke detectors. If smoke is sensed, the repeater panel (normally on the bridge) automatically sounds an alarm (not localized). The crew can then determine at the smoke sensing unit which cargo hold is on fire and operate the pertinent three-way valve for discharge of the extinguishing agent. (FSS Code, Ch. 10/2.1.1.1)

4.2.2.4 Any required system shall be capable of continuous operation at all times except that systems operating on a sequential scanning principle may be accepted, provided that the interval between scanning the same position twice gives a maximum allowable interval determined as follows:

The interval (I) should depend on the number of scanning points (N) and the response time of the fans (T), with a 20% allowance:

$$I = 1.2 \times T \times N$$

However, the maximum allowable interval should not exceed 120 s (I_{max} = 120 s). (FSS Code, Ch. 10/2.1.2)

4.2.2.5 The system shall be designed, constructed and installed so as to prevent the leakage of any toxic or flammable substances or fire-extinguishing media into any accommodation space, service space, control station or machinery space. (FSS Code, Ch. 10/2.1.3)

4.2.2.6 The system and equipment shall be suitably designed to withstand supply voltage variations and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships and to avoid the possibility of ignition of a flammable gas-air mixture. (FSS Code, Ch. 10/2.1.4)

4.2.2.7 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. (FSS Code, Ch. 10/2.1.5)

4.2.2.8 An alternative power supply for the electrical equipment used in the operation of the system shall be provided. (FSS Code, Ch. 10/2.1.6)

4.2.3 Component requirements

4.2.3.1 The sensing unit shall be certified to operate before the smoke density within the sensing chamber exceeds 6.65% obscuration per metre. (FSS Code, Ch. 10/2.2.1)

4.2.3.2 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 of par. 4.2.6.3 (FFS Code, par. 2.4.2.2). Sampling pipes shall be a minimum of 12 mm internal diameter. The fan suction capacity should be adequate to ensure the response of the most remote area within the required time criteria in par. 4.2.6.3 (FFS Code, par. 2.4.2.2). Means to monitor airflow shall be provided in each sampling line. (FSS Code, Ch. 10/2.2.2)

4.2.3.3 The control panel shall permit observation of smoke in the individual sampling pipes. (FSS Code, Ch. 10/2.2.3)

4.2.3.4 The sampling pipes shall be so designed as to ensure that, as far as practicable, equal quantities of airflow are extracted from each interconnected accumulator. (FSS Code, Ch. 10/2.2.4)

4.2.3.5 Sampling pipes shall be provided with an arrangement for periodically purging with compressed air. (FSS Code, Ch. 10/2.2.5)

4.2.3.6 The 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 be used as determined by the Administration. (FSS Code, Ch. 10/2.2.6)

4.2.4 Installation requirements

4.2.4.1 Smoke accumulators

4.2.4.1.1 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 or refrigerated cargo alternatively with cargoes for which a smoke sampling system is required, means may be provided to isolate the smoke accumulators in such compartments for the system. Such means shall be to the satisfaction of the Administration. (FSS Code, Ch. 10/2.3.1.1)

4.2.4.1.2 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 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 is to 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. (FSS Code, Ch. 10/2.3.1.2)

4.2.4.1.3 Smoke accumulators shall be positioned where impact or physical damage is unlikely to occur. (FSS Code, Ch. 10/2.3.1.3)

4.2.4.1.4 Sampling pipe networks shall be balanced to ensure compliance with par. 4.2.3.4 (FFS Code par. 2.2.4). The number of accumulators connected to each sampling pipe shall ensure compliance with par. 4.2.6.3 (FSS Code, par. 2.4.2.2). (FSS Code, Ch. 10/2.3.1.4)

4.2.4.1.5 Smoke accumulators from more than one enclosed space shall not be connected to the same sampling pipe. (FSS Code, Ch. 10/2.3.1.5)

4.2.4.1.6 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. (FSS Code, Ch. 10/2.3.1.6)

4.2.4.2 Sampling pipes

4.2.4.2.1 The sampling pipe arrangements shall be such that the location of the fire can be readily identified. (FSS Code, Ch. 10/2.3.2.1)

4.2.4.2.2 Sampling pipes shall be self-draining and suitably protected from impact or damage from cargo working. (FSS Code, Ch. 10/2.3.2.2)

4.2.5 System control requirements

4.2.5.1 Visual and audible fire signals

4.2.5.1.1 The detection of smoke or other products of combustion shall initiate a visual and audible signal at the control panel and indicating units. (FSS Code, Ch. 10/2.4.1.1)

4.2.5.1.2 The 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*. (FSS Code, Ch. 10/2.4.1.2)

Location of the control panel should be marked with symbol used on *Fire Control Plan*.

*** *IACS and IMO interpretation***

If the CO_2 system discharge pipes are used for the sample extraction smoke detection system, the control panel can be located in the CO_2 room provided that an indicating unit is located on the navigation bridge.

Indicating unit has the same meaning as repeater panel and observation of smoke should be made either by electrical means or by visual on repeater panel. (IACS UI SC260, MSC.1/Circ.1487)

4.2.5.1.3 Clear information shall be displayed on or adjacent to the control panel and indicating units designating the spaces covered. (FSS Code, Ch. 10/2.4.1.3)

4.2.5.1.4 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. (FSS Code, Ch. 10/2.4.1.4)

4.2.5.1.5 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. (FSS Code, Ch. 10/2.4.1.5)

4.2.5.1.6 The system shall be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared. (FSS Code, Ch. 10/2.4.1.6)

4.2.6 Testing

4.2.6.1 Suitable instructions and component spares shall be provided for the testing and maintenance of the system. (FSS Code, Ch. 10/2.4.2.1)

4.2.6.2 After fitting on board, all sampling pipe of the system shall be tested for tightness using compressed air or nitrogen.

4.2.6.3 After installation, the system shall be functionally tested, in accordance with the agreed acceptance and test program, 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. (FSS Code, Ch. 10/2.4.2.2)

CHAPTER 5

5 FIRE-FIGHTING AND ESCAPE EQUIPMENT, SPARES AND TOOLS

5.1 General requirements

5.1.1 Fire-fighting and escape 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.

5.1.2 The location on board the ship of each equipment specified in the present chapter 5 should be indicated by a marking plates with the symbol used on *Fire Control Plan*. The plates should be made of photoluminescent material complying with the requirements specified in IMO Res. A.752(18) or ISO 15370:2010, or from other material and marked by lighting supplied from the emergency source of power.

5.1.3 Additionally, such marking plates should be placed on the other fire safety devices/ components as specified in particular paragraphs of this *Part V*, in accordance with the symbols given in IMO Res. A.952(23) and Res. A.1116(30).

5.1.4 Spare fire-fighting and escape equipment shall be stored in the fire locker or in other space specially designed for this purpose. It is recommended that there should be two fire lockers on the ship, one of them being located within superstructure.

5.1.5 Each fire locker shall be lighted from an emergency source of electrical power and indicated at entrance door, by a plate with the symbol used on *Fire Control Plan*.

5.1.6 Suitable space/stand for overhauling and maintenance of stored equipment to ensure its readiness for immediate use shall be provided in the fire locker.

5.1.7 A set consisting of crowbar and fire axe shall be located inside accommodation spaces area, near exits.

5.1.8 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.

5.1.9 Fire-fighting equipment protecting against the effect of fire, such as fire blankets, protective clothing, gloves, etc. shall be supplied by the manufacturer with an asbestos-free declaration as specified in Appendix 7 Appendix 7 to the "2015 Guidelines for the Development of the Inventory of Hazardous Materials" (Res. MEPC.269(68)). (MSC.1/Circ.1426/Rev.1) and (IACS UI SC249).

5.2 Portable and mobile fire-extinguishers

5.2.1 Type and design

5.2.1.1 All fire extinguishers shall be of approved types and designs based on the guidelines developed by Organization * and PN-EN 3-7standard. (FSS Code, Ch. 4/2)

* Refer to the *Guidelines for marine portable fire extinguishers* adopted by the Organization by resolution A.951(23).

5.2.1.2 Each powder or carbon dioxide extinguisher shall have a capacity of at least 5 kg and each foam extinguisher shall have a capacity of at least 9 *l*. The mass of all portable fire extinguishers shall not exceed 23 kg and they shall have a fire-extinguishing capability at least equivalent to that of a 9 *l* fluid extinguisher. (FSS Code, Ch. 4/3.1.1.1)

5.2.1.3 The Administration shall determine the equivalents of fire extinguishers. (FSS Code, Ch. 4/3.1.1.2)

Fire-extinguishers with fire-extinguishing capability equivalent to that of 9 *l* foam fire-extinguisher may be considered as equivalent.

Dry powder fire extinguishers having a capacity at least 4 kg and water mist fire extinguishers having a capacity at least 6 *l* are considered as equivalent means to fight fires of group A.

5.2.1.4 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.

5.2.1.5 Mobile fire-extinguishers are extinguishers with a capacity of at least 20 kg of the extinguishing agent, equipped with propellant gas starting devices enabling immediate, independent fire-fighting, mounted on wheels.

5.2.1.6 Mobile fire extinguishers shall be of an approved type, based on the PN-EN 1866-1 standard.

5.2.2 Recharging*

Only refills approved for the fire extinguisher in question shall be used for recharging. (FSS Code, Ch. 4/3.1.2)

**** IMO interpretation***

Partially emptied extinguishers should also be recharged. (MSC/Circ.1120)

5.2.3 Arrangement of fire extinguishers*

5.2.3.1 Accommodation spaces, service spaces and control stations shall be provided with portable fire extinguishers of appropriate types and in sufficient number to the satisfaction of the Administration. Ships of 1,000 gross tonnage and upwards shall carry at least five portable fire extinguishers. (SOLAS II-2/10.3.2.1)

Arrangement of fire extinguishers on cargo ships of less than 500 gross tonnage – see sub chapter 9.17.

5.2.3.2 One of the portable fire extinguishers intended for use in any space shall be stowed near the entrance to that space.* (SOLAS II-2/10.3.2.2)

**** IMO interpretation***

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.

If a space is locked when unmanned, portable fire extinguishers required for that space may be kept inside or outside the space. (MSC.1/Circ.1275)

5.2.3.3 Carbon dioxide fire extinguishers shall not be placed in accommodation spaces and in rooms/zones at risk of explosion. (SOLAS II-2/10.3.2.3)

5.2.3.4 In control stations and other spaces containing electrical or electronic equipment or appliances necessary for the safety of the ship, fire extinguishers should be provided whose extinguishing media are neither electrically conductive nor harmful to the equipment and appliances. (SOLAS II-2/10.3.2.3)

5.2.3.5 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 a fire, and in such a way that their serviceability is not impaired by the weather, vibration or other external factors. Portable fire extinguishers shall be provided with devices which indicate whether they have been used. (SOLAS II-2/10.3.2.4)

5.2.3.6 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.

5.2.3.7 The selection of portable fire extinguishers should be appropriate to the fire hazard(s) in the space in accordance with the *Guidelines for marine portable fire extinguishers*, as adopted by resolution A.951(23). The classes of portable fire extinguishers in the table are only for reference. (MSC.1/Circ.1275/Corr.1)

5.2.3.8 The recommended number and arrangement of portable fire extinguishers in the various types of ship spaces, based on MSC.1/Circ.1275/Corr.1, is given in the table 5.2.

Table 5.2
Minimum numbers and distribution of portable fire extinguishers in the various types of spaces on board ships

Type of spaces		Minimum number of extinguishers	Class(es) of extinguisher(s) (NFPA 10)
Accommodation spaces	Public spaces	1 per 250 m^2 of deck area or fraction thereof	A
	Corridors	Travel distance to extinguishers should not exceed 25 m within each deck and main vertical zone	A
	Stairway	0	
	Lavatories, cabins, offices, pantries containing no cooking appliances	0	
	Hospital	1	A
Service spaces	Laundry drying rooms, pantries containing cooking appliances	1[2)]	A or B
	Lockers and store rooms (having a deck area of 4 m^2 or more), mail and baggage rooms, specie rooms, workshops (not part of machinery spaces, galleys)	1[2)]	B
	Galleys	1, class B and 1 additional class F or K for galleys with deep fat fryers	B, F or K
	Lockers and store rooms (deck area is less than 4 m^2)	0	
	Other spaces in which flammable liquids are stowed	In accordance with SOLAS reg. II-2/10.6.3	

Type of spaces		Minimum number of extinguishers	Class(es) of extinguisher(s) (NFPA 10)
Control stations	Control stations (other than wheelhouse)	1	A or C
	Wheelhouse	2, if the wheelhouse is less than 50 m^2 only 1 extinguisher is required[3]	A or C
Machinery spaces of category A	Central control station for propulsion machinery	1, and 1 additional extinguisher suitable for electrical fires when main switchboards are arranged in central control station	A and/or C
	Vicinity of the main switchboards	2	C
	Workshops	1	A or B
	Enclosed space with oil-fired inert gas generators, incinerators and waste disposal units	2	B
	Separately enclosed room with fuel oil purifiers	0	
	Periodically unattended Machinery spaces of category A	1 at each entrance[1]	B
Other spaces	Workshops forming part of machinery spaces and other machinery spaces (auxiliary spaces, electrical equipment spaces, auto – telephone exchange rooms, air conditioning spaces and other similar spaces)	1	B or C
	Weather deck	0[4]	B
	Ro-ro spaces and vehicle spaces	Spaced not more than 20 m apart on both sides of the space at each deck level in each hold or compartment where vehicles are carried[4] [5]	B
	Cargo spaces	0[4]	B
	Cargo pump-room	2	B
	Helidecks	In accordance with SOLAS reg. II-2/18.5.1	B

NOTES:

1) A portable fire extinguisher required for a small space may be located outside and near the entrance to that space.

2) For service spaces, a portable fire extinguisher required for that small space placed outside or near the entrance to that space may also be considered as part of the requirement for the space in which it is located.

3) If the wheelhouse is adjacent with the chartroom and has a door giving direct access to chartroom, no additional fire extinguisher is required in the chart room. The same applies to safety centers if they are within the boundaries of the wheelhouse in passenger ships.

4) Two portable fire extinguishers, each having a capacity of not less than 6 kg of dry powder or equivalent, should be provided when dangerous goods are carried on the weather deck, in open ro-ro spaces and vehicle spaces, and in cargo spaces as appropriate. Two portable fire extinguishers, each having a suitable capacity, should be provided on weather deck for tankers.

5) No portable fire extinguisher needs to be provided in cargo holds of containerships if motor vehicles with fuel in their tank for their own propulsion are carried in open or closed containers.

Fire classifications, based on IMO Res. A.951(23), are generally indicated as A, B, C, D and F (or K). There are currently two standards, defining classes of fires according to the nature of the material undergoing combustion, as follows:

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

5.2.4 Spare charges

5.2.4.1 In cargo ships of 500 gross tonnage and upwards engaged on international voyages 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. Not more than 60 total spare charges are required. Instructions for recharging shall be carried on board. (SOLAS II-2/10.3.3.1)

5.2.4.2 For fire extinguishers which cannot be recharged onboard, additional portable fire extinguishers of the same quantity, type, capacity and number as determined in par. 5.2.4.1 above shall be provided in lieu of spare charges. (SOLAS II-2/10.3.3.2)

5.2.4.3 On ships engaged on domestic voyages, the number of spare fire extinguishers should be at least 50% of the total number of fire extinguishers required.

5.2.4.4 Spare charges shall be stored in the fire locker or in other designated space.

5.3 Portable foam applicators

5.3.1 A 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, together with a portable tank containing at least 20 *l* of foam concentrate and at least one spare tank of foam concentrate of the same capacity. (FSS Code, Ch. 4/3.2.1)

5.3.2 The nozzle/branch pipe and inductor shall be capable of producing effective foam suitable for extinguishing an oil fire, at a foam solution flow rate of at least 200 *l*/min at the nominal pressure in the fire main. (FSS Code, Ch. 4/3.2.2.1)

5.3.3 The foam concentrate shall be approved by the Administration based on guidelines developed by Organization *. (FSS Code, Ch. 4/3.2.2.2)

* Refer to the *Guidelines for the performance and testing criteria and surveys of low-expansion foam concentrates for fixed fire-extinguishing systems* (MSC.1/Circ.1312/Corr.1).

5.3.4 The values of the foam expansion and drainage time of the foam produced by the portable foam applicator unit shall not differ more than ± 10% of that determined in par 5.3.3. (FSS Code, Ch. 4/3.2.2.3)

5.3.5 The portable foam applicator unit shall be designed to withstand clogging, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered on ships. (FSS Code, Ch. 4/3.2.2.4)

5.4 Fire-fighter's outfit

A fire-fighter's outfit shall consist of a set of personal equipment and a breathing apparatus. (FSS Code, Ch. 3/2.1)

5.4.1 Personal equipment

Personal equipment shall consist of the following:

.1 protective clothing of material to protect the skin from the heat radiating from the fire and from burns and scalding by steam. The outer surface shall be water-resistant;

.2 fire fighter's gloves and boots of rubber or other electrically non-conducting material;

.3 rigid helmet providing effective protection against impact;

.4 electric safety lamp (hand lantern) of an approved type with a minimum burning period of 3 h. Electric safety lamps on tankers and those intended to be used in hazardous areas shall be of an explosion-proof type*; and

* Refer to the recommendations of the International Electrotechnical Commission, in particular publication *IEC 60079, Electrical Apparatus for Explosive Gas Atmospheres.*

.5 fireman's belt with axe, with a handle provided with high-voltage insulation. (FSS Code, Ch. 3/2.1.1)

5.4.2 Breathing apparatus (SCBA)

5.4.2.1 Breathing apparatus shall be a self-contained compressed air breathing apparatus for which the volume of air contained in the cylinders shall be at least 1,200 l, or other self-contained breathing apparatus which shall be capable of functioning for at least 30 min. All air cylinders for breathing apparatus shall be interchangeable. (FSS Code, Ch. 3/2.1.2.1)

5.4.2.2 Compressed air breathing apparatus shall be fitted with an audible alarm and a visual or other device* which will alert the user before the volume of the air in the cylinder has been reduced to no less than 200 *l*. (FSS Code, Ch. 3/2.1.2.2)

* ***IMO interpretation***

A pressure indicator, with which the user can read that the volume of remaining air in the cylinder has been reduced to no less than 200 l, regardless of the need for supplemental lighting, may be regarded as a visual device. (MSC.1/Circ.1499)

5.4.3 Lifeline

For each breathing apparatus a fireproof lifeline of at least 30 m in length shall be provided. The lifeline shall successfully pass an approval test by statical load of 3.5 kN for 5 min without failure. The lifeline shall be capable of being attached by means of a snap-hook to the harness of the apparatus or to a separate belt in order to prevent the breathing apparatus becoming detached when the lifeline is operated. (FSS Code, Ch. 3/2.1.3)

5.4.4 Arrangement of fire-fighter's outfits

The number and arrangement of fire-fighter's outfits on bord cargo ships– see sub-chapter 6.7.

5.5 Emergency escape breathing devices (EEBD)

5.5.1 General

5.5.1.1 An EEBD is a supplied air or oxygen device only used for escape from a compartment that has a hazardous atmosphere and shall be of an approved type. (FSS Code, Ch. 3/2.2.1.1)

5.5.1.2 EEBDs shall not be used for fighting fires, entering oxygen deficient voids or tanks, or worn by fire-fighters. In these events, a self-contained breathing apparatus, which is specifically suited for such applications, shall be used. (FSS Code, Ch. 3/2.2.1.2)

5.5.2 Definitions

For the purposes of this sub-chapter 5.5, the following definitions apply:

.1 ***Face piece*** means a face covering that is designed to form a complete seal around the eyes, nose and mouth which is secured in position by a suitable means. (FSS Code, Ch. 3/2.2.2.1)

.2 ***Hood*** means a head covering which completely covers the head, neck, and may cover portions of the shoulders. (FSS Code, Ch. 3/2.2.2.2)

.3 ***Hazardous atmosphere*** means any atmosphere that is immediately dangerous to life or health. (FSS Code, Ch. 3/2.2.2.3)

5.5.3 Particulars

5.5.3.1 The EEBD shall have a service duration of at least 10 min. (FSS Code, Ch. 3/2.2.3.1)

5.5.3.2 The EEBD shall include a hood or full face piece, as appropriate, to protect the eyes, nose and mouth during escape. Hoods and face pieces shall be constructed of flame resistant materials and include a clear window for viewing. (FSS Code, Ch. 3/2.2.3.2)

5.5.3.3 An inactivated EEBD shall be capable of being carried hands-free. (FSS Code, Ch. 3/2.2.3.3)

5.5.3.4 An EEBD, when stored, shall be suitably protected from the environment. (FSS Code, Ch. 3/2.2.3.4)

5.5.3.5 Brief instructions or diagrams clearly illustrating their use shall be clearly printed on the EEBD. The donning procedures shall be quick and easy to allow for situations where there is little time to seek safety from a hazardous atmosphere. (FSS Code, Ch. 3/2.2.3.5)

5.5.4 Markings

Maintenance requirements, manufacturer's trademark and serial number, shelf life with accompanying manufacture date and name of approving authority shall be printed on each EEBD. All EEBD training units shall be clearly marked. (FSS Code, Ch. 3/2.2.4)

5.5.5 Arrangement of EEBD

The number and arrangement of EEBD on bord cargo ships – see sub-chapter 2.3.2.7 and 2.3.3.7.

5.6 Spare parts and tools

5.6.1 Spare parts for fixed fire-extinguishing and fire alarm systems and tools for assembly shall be stored on board. The recommended numbers of spares and tools are specified in particular paragraphs of this *Part V*. Recommendations of the systems manufacturers should also be taken into account during determining the number of spares.

5.6.2 Spares and tools for fire-extinguishing systems shall be kept in a fire locker or other space provided for this purpose.

5.6.3 Spare parts shall be properly marked to identify their use.

CHAPTER 6

6 FIRE PROTECTION OF SHIPS SPACES AND ARRANGEMENT OF FIRE-FIGHTING EQUIPMENT

6.1 Fire protection of accommodation spaces, service spaces and control stations

6.1.1 Fixed fire detection and fire alarm system

6.1.1.1 Accommodation and service spaces and control stations* of cargo ships shall be protected by a fixed fire detection and fire alarm system and/or an automatic sprinkler, fire detection and fire alarm system as follows depending on a protection method adopted in accordance with sec. 2.2.2 (SOLAS reg. 9.2.3.1):

***** ***IMO interpretation***

As no reference to control stations is made for any of the protection methods provided in accordance with sub-par. below *(SOLAS reg. II-2/7.5.5.1, 7.5.5.2 and 7.5.5.3), control stations on cargo ships do not need to be covered by a fixed fire detection and fire alarm system. (MSC.1/Circ.1456)*

.1 Method IC

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. (SOLAS II-2/7.5.5.1)

.2 Method IIC

An automatic sprinkler, fire detection and fire alarm system of an approved type complying with the relevant requirements of sub-chapter 3.3 (FSS Code) shall be so installed and arranged as to protect accommodation spaces, galleys and other service spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc. In addition, a fixed 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. (SOLAS II-2/7.5.5.2, SOLAS II-2/10.6.2)

.3 Method IIIC

A fixed fire detection and fire alarm system shall be so installed and arranged as to detect the presence of fire in all accommodation spaces and service spaces* providing smoke detection in corridors, stairways and escape routes within accommodation spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc. In addition, a fixed fire detection and fire alarm system shall be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces. (SOLAS II-2/7.5.5.3)

***** ***IACS interpretation***

In the case of ships built in accordance with Method IIIC, the detection system is only relevant to the accommodation block. Service spaces built away from the accommodation block need not be fitted with a fixed fire detection system. (IACS UI SC160)

6.1.2 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 of *Part VI,* sub-chapter 7.7, to ensure that, in the event of fire, the machinery and equipment contained therein may be supervised and continue to function effectively.

6.1.3 Portable fire -extinguishers

The arrangement of fire-extinguishers – see sec. 5.2.3.

6.2 Fire extinguishing arrangements in machinery spaces

6.2.1 Fixed fire-extinguishing systems

6.2.1.1 Types of fixed fire extinguishing systems

6.2.1.1.1 A fixed fire extinguishing system required by sec. 6.2.2 to 6.2.4 (SOLAS reg. 10.5) below may be any of the following systems:

- **.1** a fixed gas fire-extinguishing system complying with the provisions of sub-chapter 3.6 (FSS Code) or equivalent;
- **.2** a fixed high-expansion foam fire-extinguishing system complying with the provisions of sec. 3.5.3 (FSS Code); and
- **.3** a fixed pressure water-spraying fire-extinguishing system complying with the provisions of sec. 3.4.2 (FSS Code). (SOLAS II-2/10.4.1.1)

6.2.1.1.2 Where a fixed fire-extinguishing system not required by this *Part V* (chapter) is installed, it shall meet the requirements of the relevant regulations of chapter 3 (FSS Code). (SOLAS II-2/10.4.1.2)

6.2.2 Machinery spaces containing oil-fired boilers or oil fuel units

6.2.2.1 Fixed fire-extinguishing systems

On ships of 150 gross tonnage and upwards, machinery spaces of category A containing oil-fired boilers or oil fuel units shall be provided with any one of the fixed fire-extinguishing systems in par. 6.2.1.1 (SOLAS par. 10.4.1). In each case, if the engine and boiler rooms are not entirely separate, or if fuel oil can drain from the boiler room into the engine-room, the combined engine and boiler rooms shall be considered as one compartment. (SOLAS II-2/10.5.1.1)

6.2.2.2 Additional fire-extinguishing arrangements*

*** *IACS and IMO interpretation***

Number of systems, appliances and extinguishers required by this sec. 6.2.2 (SOLAS Reg. II-2/10.5.1 and 10.5.2) – see sec. 5.2.3 (MSC.1/Circ.1275). (IACS UI SC30, MSC/Circ.1120, reg. 10.5)

6.2.2.2.1 There shall be in each boiler room or at an entrance outside of the boiler room at least one portable foam applicator unit complying with the provisions of sub-chapter 5.3 (FSS Code). (SOLAS II-2/10.5.1.2.1)

6.2.2.2.2 There shall be at least two portable foam extinguishers or equivalent in each firing space in each boiler room and in each space in which a part of the oil fuel installation is situated. There shall be not less than one approved foam-type extinguisher of at least 135 *l* capacity or equivalent in each boiler room. These extinguishers shall be provided with hoses on reels suitable for reaching any part of the boiler room. In the case of domestic boilers of less than 175 kW, or boilers protected by fixed water-based local application fire-extinguishing systems as required by sec. 6.2.7 (SOLAS par. 5.6), an approved foam-type extinguisher of at least 135 *l* capacity is not required. (SOLAS II-2/10.5.1.2.2)

6.2.2.2.3 In each firing space there shall be a receptacle containing at least 0.1 m^3 sand, sawdust impregnated with soda, or other approved dry material, along with a suitable shovel for spreading the material. An approved portable extinguisher may be substituted as an alternative*. (SOLAS II-2/10.5.1.2.3)

*** IACS interpretation**
Sand boxes may be substituted by approved portable fire extinguishers. (IACS UI SC30)

6.2.2.2.4 During design, assembly and maintenance of machinery systems and equipment, "Guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms", given in MSC.1/Circ.1321, should be taken into account.

6.2.3 Machinery spaces of category A containing internal combustion machinery

6.2.3.1 Fixed fire-extinguishing systems

On ships of 150 gross tonnage and upwards, machinery spaces of category A containing internal combustion machinery shall be provided with one of the fixed fire-extinguishing systems in par. 6.2.1.1 (SOLAS par. 10.4.1). (SOLAS II-2/10.5.2.1)

6.2.3.2 Additional fire-extinguishing arrangements *

*** IACS and IMO interpretation**
Number of systems, appliances and extinguishers required by this sec. 6.2.2 (SOLAS Reg. II-2/10.5.1 and 10.5.2) – see sec. 5.2.3 (MSC.1/Circ.1275). (IACS UI SC30, MSC/Circ.1120, reg. 10.5)

6.2.3.2.1 There shall be at least one portable foam applicator unit* complying with the provisions of sub-chapter 5.3 (FSS Code). (SOLAS II-2/10.5.2.2.1)

*** IACS and IMO interpretation**
May be located at outside of the entrance to the room. (IACS UI SC30, MSC/Circ.1120)

6.2.3.2.2 There shall be in each such space approved foam-type fire extinguishers*, each of at least 45 *l* capacity or equivalent, sufficient in number to enable foam or its equivalent to be directed on to any part of the fuel and lubricating oil pressure systems, gearing and other fire hazards. In addition, there shall be provided a sufficient number of portable foam extinguishers or equivalent which shall be so located that no point in the space is more than 10 m walking distance from an extinguisher and that there are at least two such extinguishers in each such space. For smaller spaces of cargo ships the Administration may consider relaxing this requirement. (SOLAS II-2/10.5.2.2.2)

*** IACS and IMO interpretation**
For smaller spaces of cargo ships, the 45 l foam-type fire extinguisher may be arranged outside of the space concerned. (IACS UI SC30, MSC/Circ.1120)

6.2.3.2.3 It is recommended that atmospheric oil mist detectors be installed in machinery spaces of category A, in places of potential fuel/ oil leakage, in accordance with "Code of practice for atmospheric oil mist detectors", as given in MSC/Circ.1086.

6.2.3.2.4 During design, assembly and maintenance of machinery systems and equipment, "Guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms", given in MSC.1/Circ.1321, should be taken into account.

6.2.4 Machinery spaces containing steam turbines or enclosed steam engines

6.2.4.1 Fixed fire-extinguishing systems

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 fire-extinguishing systems specified in par. 6.2.1.1 (SOLAS par. 10.4.1) shall be provided if such spaces are periodically unattended. (SOLAS II-2/10.5.3.1)

6.2.4.2 Additional fire-extinguishing arrangements *

*** IACS and IMO interpretation***

Number of systems, appliances and extinguishers required by this sec. 6.2.2 (SOLAS Reg. II-2/10.5.1 and 10.5.2) – see sec. 5.2.3 (MSC.1/Circ.1275). (IACS UI SC30, MSC/Circ.1120, reg. 10.5)

6.2.4.2.1 There shall be approved foam fire extinguishers each of at least 45 *l* capacity or equivalent sufficient in number to enable foam or its equivalent to be directed on to any part of the pressure lubrication system, on to any part of the casings enclosing pressure lubricated parts of the turbines, engines or associated gearing, and any other fire hazards. However, such extinguishers shall not be required if protection, at least equivalent to that required by this sub-paragraph, is provided in such spaces by a fixed fire-extinguishing system fitted in compliance with par. 6.2.1.1 (SOLAS par. 10.4.1). (SOLAS II-2/10.5.3.2.1)

6.2.4.2.2 There shall be a sufficient number of portable foam extinguishers or equivalent which shall be so located that no point in the space is more than 10 m walking distance from an extinguisher and that there are at least two such extinguishers in each such space, except that such extinguishers shall not be required in addition to any provided in compliance with par. 6.2.2.2.2 (SOLAS par. 10.5.1.2.2). (SOLAS II-2/10.5.3.2.2)

6.2.5 Other machinery spaces

Where, in the opinion of the Administration, a fire hazard exists in any machinery space for which no specific provisions for fire-extinguishing appliances are prescribed in sec. 6.2.2, 6.2.3 and 6.2.4 (SOLAS par. 5.1, 5.2 and 5.3), there shall be provided in, or adjacent to, that space such a number of approved portable fire extinguishers or other means of fire extinction as the Administration may deem sufficient. (SOLAS II-2/10.5.4)

6.2.6 Segregation of fuel oil purifiers room

Requirements for room with oil purifiers for heated fuel oil – see par. 8.10.1.4.5.3.2 of *Part VI*.

6.2.7 Fixed water-based local application fire-fighting systems

6.2.7.1 This section 6.2.7 (par. 5.6) shall apply to (...) cargo ships of 2000 gross tonnage and above. (SOLAS II-2/10.5.6.1)

6.2.7.2 Machinery spaces of category A above 500 m^3 in volume shall, in addition to the fixed fire-extinguishing system required in par. 6.2.1.1 (SOLAS par. 10.5.1.1), be protected by an approved type of fixed water-based or equivalent local application fire-fighting system, complying with sec. 3.4.4 (based on the guidelines developed by Organization)*. In the case of periodically unattended machinery spaces, the fire-fighting system shall have both automatic** and manual release capabilities. In the case of continuously manned machinery spaces, the fire-fighting system is only required to have a manual release capability. (SOLAS II-2/10.5.6.2)

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* Refer to *Revised Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces* (MSC.1/Circ.1387/Corr.1), *Unified interpretations of the Guidelines for the approval of fixed water-based local application fire-fighting systems (MSC/Circ.913) (MSC/Circ.1082)* and *Unified interpretations of SOLAS chapter II-2 (MSC.1/Circ.1276/Rev.1, IACS UI SC217/Corr.2).*

***** IACS interpretation***

The automatic release should be activated by a detection system capable of reliably identifying the local zones. Consideration should be given to prevent accidental release. (IACS UI SC217)

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

.1 the fire hazard portions of internal combustion machinery*;

*** IMO interpretation**

Hot surfaces such as exhaust pipes without insulation or with insulation likely to be removed frequently for maintenance and high-pressure fuel oil systems installed nearby the hot surfaces should be protected.

The term "insulation likely to be removed frequently" means insulation fitted in accordance with the requirements of SOLAS reg. II-2/4.2.2.6.1, but which might not be secured firmly because it may be removed frequently for periodic maintenance, such as pipes between cylinders and exhaust manifold.

For typical diesel engines, the area on top of the engine, fuel oil injection pumps and turbo chargers should be protected. Where the fuel oil injection pumps are located in sheltered position such as under the steel platform, the pump need not be protected by the system. (MSC/Circ1120)

*** IACS interpretation**

*In multi-engine installations, at least two sections shall be arranged.**

(refer to item 3.2.4 of MSC.1/Circ.1387) (IACS UI SC198)*

.2 boiler fronts*;

*** IMO interpretation**

The area around the burners without insulation or with insulation likely to be removed frequently for maintenance should be protected. The term "insulation likely to be removed frequently" means insulation fitted in accordance with the requirements of SOLAS reg. II-2/4.2.2.6.1, but which might not be secured firmly because it may be removed frequently for periodic maintenance.

Oil-fired inert gas generators should be also protected in the same manner. (MSC/Circ1120)

*** IACS and IMO interpretation**

Boiler fronts should be interpreted as the boiler burner location irrespective of the boiler design. (IACS UI SC176/Rev.1, MSC.1/Circ.1387/Corr.1, An.2.3)

.3 the fire hazard portions of incinerators*; and

*** IMO interpretation**

The area around the burner(s) without insulation or with insulation likely to be removed frequently for maintenance should be protected. The term "insulation likely to be removed frequently" means insulation fitted in accordance with the requirements of SOLAS reg. II-2/4.2.2.6.1, but which might not be secured firmly because it may be removed frequently for periodic maintenance. (MSC/Circ1120)

.4 purifiers for heated fuel oil*. (SOLAS II-2/10.5.6.3)

*** IACS interpretation**

Oil fired equipment, such as inert gas generators and thermal oil heaters should also be protected by this system, if located in machinery spaces above 500 m^3. (IACS UI SC176/Rev.1)

6.2.7.4 Activation of any local application system shall give a visual and distinct audible alarm in the protected space and at continuously manned stations. The alarm shall indicate the specific system activated. The system alarm requirements described within this paragraph are in addition to, and not a substitute for, the detection and fire alarm system required elsewhere in this *Part V* (chapter). (SOLAS II-2/10.5.6.4)

6.2.7.5 It is recommended, that on all ships of 2000 gross tonnage and upwards (not only with periodically unattended machinery spaces), both automatic and manual release capabilities for the local application system be provided.

6.2.7.6 Machinery space fitted with water-based local application fire-fighting system operated automatically shall be indicated by a warning plate placed on access door, bearing the inscription:

Warning
The possibility of automatic release of water-based local application system

6.2.8 Fixed fire detection and fire alarm system in machinery spaces

6.2.8.1 Installation

A fixed fire detection and fire alarm system, complying with applicable requirements of sub-chapter 4.1, shall be installed in:

.1 periodically unattended machinery spaces* – see sub-chapter 12.5.7;
.2 machinery spaces where:
  .2.1 the installation of automatic and remote control systems and equipment has been approved in lieu of continuous manning of the space; and
  .2.2 the main propulsion and associated machinery including sources of the main sources of electrical power are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room; and
.3 enclosed spaces containing incinerators. (SOLAS II-2/7.4.1)

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IACS interpretation
This requirement applies to machinery spaces of category A. (IACS UI SC129)

6.2.8.2 Design

The fixed fire detection and fire alarm system required in par. 6.2.8.1 (SOLAS II-par. 7.4.1) shall be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is especially appropriate, detection systems using only thermal detectors shall not be permitted. The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the navigating bridge and by a responsible engineer officer. When the navigating bridge is unmanned the alarm shall sound in a place where a responsible member of the crew is on duty. (SOLAS II-2/7.4.2)

6.2.8.3 Other machinery spaces

6.2.8.3.1 It is recommended, that all other machinery spaces containing oil fuelled equipment and where combustible materials or liquid oil fuel are used in quantities that constitute a fire hazard, should be provided with a fire detection and fire alarm system, complying with relevant requirements of sub-chapter 4.1.

6.2.8.3.2 Fire detectors of more than one type should be used. In general, smoke detectors should be installed throughout the whole space. In addition, flame detectors should cover all engines, heated fuel oil separators, oil fired boilers and similar equipment. Each flame detector should cover maximum two adjacent engines.

6.2.8.3.3 It is recommended, that any workshop in machinery area be provided with smoke detectors connected to a timer function that will automatically reset after not more than 20 min. In addition, heat detectors not connected to this timer should be installed at suitable locations.

6.2.8.4 Machinery spaces containing emergency generator for use in port

Fire detectors should be installed in the location where the emergency generator set and emergency switchboard are installed. (IACS UI SC152, par.2.5)

6.2.9 TV monitoring system

It is recommended, that on ships of 2000 gross tonnage and upwards, machinery spaces of category A should be provided with CCTV monitoring system.

CCTV monitoring system should cover all engines with rated power above 375 kW, heated fuel oil separators, oil fired boilers and all oil fired equipment, except for the emergency generator which need not to be provided with this system. CCTV monitors should be available in a manned control station or in an engine control room.

6.2.10 Release of smoke from machinery spaces

Machinery spaces of category A and, where deemed necessary, other machinery spaces shall be provided with suitable arrangements to permit the release of smoke, in the event of fire, in accordance with the requirements of sec. 7.6.4 of *Part VI*.

6.2.11 Detection of oil mist in machinery spaces

It is recommended to install atmospheric oil mist detectors in machinery spaces of category A, in locations of potential oil fuel leaks, in accordance with "Code of practice for atmospheric oil mist detectors" – MSC/Circ.1086.

6.3 Spaces containing flammable liquid

6.3.1 Paint lockers shall be protected by:

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

.2 a dry powder system, designed for at least 0.5 kg powder/m^3;

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

.4 a system providing equivalent protection, as determined by the Administration.

In any case, the system shall be operable from outside the protected space. (SOLAS II-2/10.6.3.1)

6.3.2 Flammable liquid lockers* shall be protected by an appropriate fire-extinguishing arrangement approved by the Administration. (SOLAS II-2/10.6.3.2)

**** IACS interpretation***

The requirements given in 6.3.2 *and* 6.3.3 *(SOLAS Reg. II-2/10.6.3.2. and 10.6.3.3) are not considered applicable for cargo service spaces intended for the stowage of cargo samples, when such spaces are positioned within the cargo area onboard tankers. (IACS UI SC199)*

6.3.3 For lockers of a deck area of less than 4 m^2, which do not give access to accommodation spaces, a carbon dioxide portable fire extinguisher sized to provide a minimum volume of free gas equal to 40% of the gross volume of the space may be accepted in lieu of a fixed system. A discharge port 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 fire main water. (SOLAS II-2/10.6.3.3)

6.4 Fire protection of galleys

6.4.1 Exhaust ducts from galley ranges

6.4.1.1 Requirements for passenger ships carrying more than 36 passengers

See sec. 11.1.3.5 (SOLAS II-2/9.7.5.1)

6.4.1.2 Requirements for cargo ships and passenger ships carrying not more than 36 passengers

When passing through accommodation spaces or spaces containing combustible materials*, the exhaust ducts from galley ranges shall be constructed in accordance with par. 7.3.4 of *Part VI*, (SOLAS par. 7.2.4.1.1 and 7.2.4.1.2). Each exhaust duct shall be fitted with:

**** IACS interpretation***

The term "spaces containing combustible materials" will normally apply to all spaces in accommodation. (IACS UI SC106)

.1 a grease trap readily removable for cleaning;

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

**** IACS interpretation***

Fire dampers required by this par. *do not need to pass the fire test in either Res. A 754(18) or Appendix 2 of Part 3, of Annex 1 of the 2010 FTP Code, but should be of steel and capable of stopping the draught. The requirements to "A" class applies only to the part of the duct outside of the galley. (IACS UI SC118)*

.3 arrangements, operable from within the galley, for shutting off the exhaust and supply fans; and

.4 fixed means for extinguishing a fire within the duct.* (SOLAS II-2/9.7.5.2)

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* Refer to the recommendations published by the International Organization for Standardization, in particular publication *ISO 15371:2009**, *Ships and marine technology – Fire-extinguishing systems for protection of galley cooking equipment.*

**** IMO interpretation***

The reference to ISO 15371:2009 in the footnote to this par. *(both SOLAS reg. 9.7.5.1.1.3 and 9.7.5.2.4) is given as an example of a suitable performance standard for pre-engineered galley duct fixed fire-extinguishing systems.*

CO_2 fire-extinguishing systems, which are not pre-engineered fixed fire-extinguishing systems, should be designed according to the requirements set out in (SOLAS reg. 10.6.3.1.1) (spaces containing flammable liquids) or another suitable standard acceptable to the Administration. (MSC.1/Circ.1616)

6.4.2 Deep-fat cooking equipment

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

.1 an automatic or manual extinguishing system tested to an international standard acceptable to the Organization *;

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* Refer to the recommendations by the International Organization for Standardization, in particular publication *ISO 15371:2009, Ships and marine technology - Fire-extinguishing systems for protection of galley cooking equipment.*

.2 a primary and backup thermostat with an alarm to alert the operator in the event of failure of either thermostat;

.3 arrangements for automatically shutting off the electrical power upon activation of the extinguishing system;

.4 an alarm for indicating operation of the extinguishing system in the galley where the equipment is installed; and

.5 controls for manual operation of the extinguishing system which are clearly labelled for ready use by the crew. (SOLAS II-2/10.6.4)

6.4.3 Portable fire -extinguishers

The arrangement of fire-extinguishers in galley – see sec. 5.2.3.

6.5 Fire-extinguishing arrangements in cargo spaces

6.5.1 Fixed gas fire-extinguishing systems for general cargo

6.5.1.1 Except for ro-ro and vehicle spaces, cargo spaces on cargo ships of 2,000 gross tonnage and upwards shall be protected by a fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of sub-chapter 3.6 (FSS Code), or by a fire-extinguishing system which gives equivalent protection*. (SOLAS II-2/10.7.1.3)

**** IMO interpretation***

For cargoes for which a fixed gas fire-extinguishing system is ineffective and for which a fire-extinguishing system giving equivalent protection should be available, reference is made to MSC.1/Circ.1395/Rev.6, annex, table 2. (MSC/Circ.1120).

IACS interpretation

Ships (tankers) of less than 2000 tons gross tonnage carrying petroleum products having a flash point exceeding 60°C (c.c. test) are not required to be fitted with a fixed fire extinguishing system. (IACS UI SC48)

6.5.1.2 The Administration may exempt from the requirements of par. 6.5.1.1 and 6.5.2 (SOLAS par. 10.7.1.3 and 10.7.2), cargo spaces of any cargo ship if constructed, and solely intended for, the carriage of ore, coal, grain, unseasoned timber, non-combustible cargoes* or cargoes which, in the opinion of the Administration, constitute a low fire risk**. Such exemptions may be granted only if the ship is fitted with steel hatch covers and effective means of closing ventilators and other openings leading to the cargo spaces. When such exemptions are granted, the Administration shall issue an Exemption Certificate, irrespective of the date of construction of the ship concerned, in accordance with SOLAS reg. I/12(a)(vi), and shall ensure that the list of cargoes the ship is permitted to carry is attached to the Exemption Certificate. (SOLAS II-2/10.7.1.4)

**** IACS and IMO interpretation***

1. *Non-combustible cargoes, such as materials listed in par. 1 of Annex 2 to the 2010 FTP Code, need not be mentioned on exemption certificates issued under par. 6.5.1.2 (SOLAS reg. II-2/10.7.1.4).*
2. *The document of compliance with SOLAS reg. II-2/19 may not permit more cargoes than indicated in the list of cargoes attached to the exemption certificate issued under par. 6.5.1.2 (SOLAS reg. II-2/10.7.1.4). (IACS UI SC197, MSC.1/Circ.1203)*

** Refer to *IMSBC Code,* as amended, appendix 1, entry for coal, and to the *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* - MSC.1/Circ.1395/*Rev.6.*

6.5.2 Fixed gas fire-extinguishing systems for dangerous goods

A ship engaged in the carriage of dangerous goods in any cargo spaces shall be provided with a fixed carbon dioxide or inert gas fire-extinguishing system complying with sub-chapter 3.6 (the provisions of FSS Code) or with a fire-extinguishing system which, in the opinion of the Administration, gives equivalent protection for the cargoes carried*. (SOLAS II-2/10.7.2)

* *List of solid dangerous goods bulk cargoes, for which a fixed gas fire-extinguishing system is ineffective and for which a fire-extinguishing system giving equivalent protection shall be available,* see MSC.1/Circ.1395/*Rev.6*, Table 2.

**** IACS and IMO interpretations***

1. Ships carrying dangerous goods on deck only:

Any cargo space in a ship engaged in the carriage of dangerous goods on deck or in cargo spaces should be provided with a fixed gas fire-extinguishing system complying with sub-chapter 3.6 (*the provisions of the FSS Code*) *or with a fire-extinguishing system which, in the opinion of the Administration, gives equivalent protection for the cargoes carried.* (*MSC/Circ.1120*)

2. Equivalent protection:

Water supplies defined in sec. 7.2.1 (*SOLAS Reg. II-2/19.3.1.2*) *are considered as an acceptable protection for cargoes listed in Table 2 of the latest revision of MSC.1/Circ.1395.* (*IACS UI SC159, MSC/Circ.1120*)

3. Fire protection arrangements in cargo spaces:

1. *It applies both to cargo and passenger ships.*
2. *Cargo ships of less than 500 gross tonnage are not subject to* this par. 6.5.2 (*SOLAS Reg. II-2/10.7.2*) *even when such ships are engaged in the carriage of dangerous goods and documents of compliance are issued to such ships according to Reg. II-2/19.4.* (*IACS UI SC49*)

4. Application of carbon dioxide or inert system for self-heating solid bulk cargoes:

For certain individual schedules of solid bulk cargoes in Appendix 1 of the IMSBC Code as amended, such as FISHMEAL (FISHSCRAP) STABILIZED UN 2216, SEED CAKE (a) UN 1386 and SEED CAKE (b) UN 1386, SEED CAKE UN 2217, SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES of Group B the following ventilation requirement is present:

"If the temperature of the cargo exceeds 55°C and continues to increase, ventilation to the cargo space shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo spaces"

Interpretation:

This self-heating phenomenon should be regarded as an emergency condition such that it is not necessary to provide a separate fixed carbon dioxide fire-extinguishing system or inert gas system dedicated to the control of the self-heating of the cargo within the cargo holds. The fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of sub-chapter 3.6 (*the FSS Code required by SOLAS reg. II-2/10.7.1.3 or II-2/10.7.2*) *may be used for this purpose. Fixed gas fire-extinguishing systems or inert gas systems installed on board dedicated exclusively to the protection of spaces other than cargo spaces should not be used for this purpose.* (*IACS UI SC250, MSC.1/Circ.1456*)

6.5.3 Cargo areas for the stowage of containers in ships other than container ships

Fire-fighting appliances in cargo areas shall comply with requirements specified in sub-chapter 11.2 for container ships, as applicable.

6.6 Fire protection of garbage storage and processing spaces

6.6.1 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 sub-chapter 3.4. The water-spraying system may be supplied from the water fire main or fresh water pressure tank system.

If the ship is provided with an automatic sprinkler system, these spaces may be protected by that system.

6.6.2 In ships of 500 gross tonnage and upwards, incinerators rooms located outside machinery space shall be fitted with one of the fire-extinguishing systems required for machinery spaces of category A, listed in par. 6.2.1.1.

6.7 Arrangement of fire-fighter's outfits

6.7.1 Types of fire-fighter's outfits

Fire-fighter's outfits shall comply with sub-chapter 5.4 (FSS Code). (SOLAS II-2/10.10.1.1)

6.7.2 Number of fire-fighter's outfits

6.7.2.1 Ships shall carry at least two fire-fighter's outfits. (SOLAS II-2/10.10.2.1)

Cargo ships of less than 500 gross tonnage but 150 and upwards (not subjected to SOLAS Conv.) should carry at least one (1) set of fire-fighter's outfits.

6.7.2.2 The Administration may require additional sets of personal equipment and breathing apparatus, having due regard to the size and type of the ship. (SOLAS II-2/10.10.2.4)

6.7.2.3 Two spare charges shall be provided for each required breathing apparatus. (...) Cargo ships that are equipped with suitably located means for fully recharging the air cylinders free from contamination, need carry only one spare charge for each required apparatus. (SOLAS II-2/10.10.2.5)

6.7.2.4 An onboard means of recharging breathing apparatus cylinders used during drills shall be provided or a suitable number of spare cylinders* shall be carried on board to replace those used. (SOLAS II-2/15.2.2.6)

*** *IACS and IMO interpretations***

Interpretation regarding suitable number of spare air cylinders:

1 *"A suitable number of spare cylinders" to be carried on board to replace those used for fire drills should be at least one "set of cylinders" for each mandatory breathing apparatus, unless additional spare cylinders are required by the shipboard safety management system (SMS).*

2 *"Set of cylinders" means the number of cylinders which are required to operate the breathing apparatus.*

3 *No additional cylinders are required for fire drills for breathing apparatus sets required by SOLAS Reg. II-2/19, IMSBC Code, IBC Code or IGC Code.* (IACS UI SC275, MSC.1/Circ.1555)

6.7.2.5 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 should be indicated with the symbol used on *Fire Control Plan*.

6.7.2.6 On ships fitted with means/ compressor for recharging the air cylinders, at least one spare cylinder for recharging breathing apparatus during periodical operation tests of compressor shall be provided.

6.7.3 Storage of fire-fighter's outfits

The fire-fighter's outfits or sets of personal equipment shall be kept ready for use in an easily accessible location that is permanently and clearly marked and, where more than one fire- fighter's outfit or more than one set of personal equipment is carried, they shall be stored in widely separated positions. (SOLAS II-2/10.10.3.1)

6.7.4 Fire-fighter's communication

For ships subject to *SOLAS Convention*, min. of two (2) two-way portable radiotelephone apparatus* for each fire party for fire-fighter's communication shall be carried on board. Those two-way portable radiotelephone apparatus shall be of an explosion-proof type or intrinsically safe. (SOLAS II-2/10.10.4)

**** IACS and IMO interpretation***

1. *Two-way portable radiotelephone apparatus for fire-fighter's communication required by (SOLAS reg. 10.10.4) should be of certified safe type suitable for use in zone 1 hazardous areas, as defined in IEC Publication 60079.*
2. *The minimum requirements in respect to the apparatus group and temperature class are to be consistent with the most restrictive requirements for the hazardous area zone on board which is accessible to fire party. (IACS UI SC291, MSC.1/Circ.1616)*

**** IMO interpretation***

Two-way portable telephone apparatus should be audible from most parts of the ship. As a minimum, they should be audible where the fire patrol makes their rounds such as key box locations and the routes specified on the fire patrol checklist. If necessary, extra antennae should be fitted to obtain effective communication. (MSC/Circ.1120)

CHAPTER 7

7 REQUIREMENTS FOR SHIPS CARRYING DANGEROUS GOODS

7.1 General requirements

7.1.1 In addition to complying with the applicable requirements of this *Part V* (regulations in parts B, C, D, E and reg. 18 and 20 of chapter II-2)*, as appropriate, ship types and cargo spaces, referred to in par. 7.1.2 (SOLAS par. 19.2.2), intended for the carriage of dangerous goods shall comply with the requirements of this chapter 7 (regulation), as appropriate, except when carrying dangerous goods in limited quantities** and excepted quantities*** unless such requirements have already been met by compliance with the requirements elsewhere in this *Part V* (chapter). The types of ships and modes of carriage of dangerous goods are referred to in par. 7.1.2 (SOLAS par. 19.2.2) and in table 19.1. Cargo ships of less than 500 gross tonnage shall comply with this chapter 7 (regulation), but Administrations may reduce the requirements and such reduced requirements shall be recorded in the document of compliance referred to in sec. 7.3 (SOLAS par. 19.4). (SOLAS II-2/19.2.1)

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* Refer to part 7 of the *IMDG Code.*

** Refer to chapter 3.4 of the *IMDG Code.*

*** Refer to chapter 3.5 of the *IMDG Code.*

7.1.2 The following ship types and cargo spaces shall govern the application of tables 19.1 and19.2:

.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 purpose-built container ships and cargo spaces intended for the carriage of dangerous goods in freight containers* and portable tanks;

*** IACS and IMO interpretation***

A purpose built container space is a cargo space fitted with cell guides for stowage securing of containers. (IACS UI SC84, MSC/Circ.1120)

.3 ro-ro ships and ro-ro spaces* intended for the carriage of dangerous goods;

*** IACS and IMO interpretation***

Ro-ro spaces include special category spaces (SOLAS, Reg. II-2/3.46) and vehicle spaces (SOLAS, Reg. II-2/3.49). (IACS UI SC85, MSC/Circ.1120).

.4 ships and cargo spaces intended for the carriage of solid dangerous goods in bulk; and

.5 ships and cargo spaces intended for carriage of dangerous goods other than liquids and gases in bulk in shipborne barges. (SOLAS II-2/19.2.2)

7.1.3 Requirements for the use fixed gas fire-extinguishing systems when ship is engaged in the carriage of dangerous goods – see sec. 6.5.2.

7.1.4 Requirements for the use additional fire hoses when ship is engaged in the carriage of dangerous goods – see par. 3.2.4.2.3.1.

7.1.5 In order to verify that the ship's structure and equipment for the carriage of declared dangerous goods conform to the requirements of this chapter 7, the following technical documentation shall be submitted for approval:

.1 water fire main system (including calculation of the required quantity of water and arrangement of fire hydrants);
.2 water spray/ cargo space flooding system;
.3 electrical installation in cargo spaces (details of electrical components/ certificates of electrical components for use in hazardous areas);
.4 fire detection and fire alarm system;
.5 ventilation systems;
.6 bilge system;
.7 structure of divisions separating cargo spaces from machinery space of category A;
.8 fire-fighting equipment arrangement plan/ *Fire Control Plan*.

7.1.6 For the purposes of this chapter 7, the division of dangerous goods into classes and groups, in accordance with the *IMDG Code* and the *IMSBC Code* applies*,* to which the following definitions apply:

DANGEROUS CARGOES CARRIED IN PACKING FORM

Division of dangerous goods into classes:

Class 1 – Explosives

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 (see 2.1.3.4); and

.3 substances and articles not mentioned under .1 and .2 which are manufactured with a view to producing a practical explosive or pyrotechnic effect. (IMDG Code, Ch. 2.1.1.1)

* *Explosive substance* means a solid or liquid substance (or a mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases.

** *Explosive article* means an article containing one or more explosive substance. (IMDG Code, Ch. 2.1.1.3)

Class 1, in terms of hazard, is subdivided into the following six divisions:

Division 1.1: substances and articles which have a mass explosion* hazard.
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. (IMDG Code, Ch. 2.1.1.4)

Subdivision 1.4 in compatibility group S (safety): 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.

* *A mass explosion* means one which affects almost the entire load virtually instantaneously. (IMDG Code, Ch. 2.1.1.3)

Class 2 – Gases

Class 2.1: flammable gases

Class 2.2: non-flammable, non-toxic gases

Class 2.3: toxic gases

Class 2.3 flammable: flammable toxic gases

Class 2.3 non-flammable: non-flammable toxic gases (IMDG Code, Ch. 2.2.2)

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 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, solid desensitized explosives and polymerizing substances

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

Substances (solids and liquids) which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities. (IMDG Code, Ch. 2.4.1)

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. (IMDG Code, Ch. 2.5.1)

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. (IMDG Code, Ch. 2.6.1)

Class 7 – Radioactive material

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. (IMDG Code, Ch. 2.7.1)

Class 8 – Corrosive substances

Corrosive substances are substances which, by chemical action, will cause irreversible damage to the skin, or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport. (IMDG Code, Ch. 2.8.1)

Class 8 liquids FP < 23°C: corrosive liquids with a flashpoint less than 23°C

Class 8 liquids 23°C ≤FP ≤ 60°C: corrosive liquids with a flashpoint 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. (IMDG Code, Ch. 2.9.1)

SOLID DANGEROUS GOODS CARRIED IN BULK

Division of dangerous goods into groups:

Group A – goods which may liquefy if shipped at a moisture content in excess of their transportable moisture limit.

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

Group C – goods which are neither liable to liquefy (group A) nor to possess chemical hazards (group B). (IMSBC Code, Section 1.7)

Solid bulk cargoes from group B, which may possess chemical hazards during transport, because of their chemical nature or properties are divided into following classes:

Class 4.1: Flammable solids

The materials in this class are readily combustible solids and solids which may cause fire through friction. (IMSBC Code, Section 9.2.2.1)

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. (IMSBC Code, Section 9.2.2.2)

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. (IMSBC Code, Section 9.2.2.3)

Class 5.1: Oxidizing substances

The materials in this class are materials that while in themselves not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material. (IMSBC Code, Section 9.2.2.4)

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. (IMSBC Code, Section 9.2.2.5)

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. (IMSBC Code, Section 9.2.2.7)

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. (IMSBC Code, Section 9.2.2.8)

Class MHB: Materials hazardous only in bulk

These are materials which, when carried in bulk, possess chemical hazards other than the hazards covered by the classification system of the IMDG Code. These materials present a significant risk when carried in bulk and require special precautions. (IMSBC Code, Section 9.2.3)

7.2 Special requirements

Unless otherwise specified, the following requirements shall govern the application of tables 19.1, 19.2 and 19.3 to both "on-deck" and "under-deck" stowage of dangerous goods where the numbers of the following paragraphs are indicated in the first column of the tables. (SOLAS II-2/19.3)

7.2.1 Water supplies

7.2.1.1 Arrangements shall be made to ensure immediate availability of a supply of water* from the fire main at the required pressure either by permanent pressurization or by suitably placed remote arrangements for the fire pumps. (SOLAS II-2/19.3.1.1)

***** ***IACS and IMO interpretation***

Water supplies for open-top container holds:

1 *The water spray system required in sec. 3.4.6 (par 9.2, 9.3 and 9.4 of MSC/Circ.608/Rev.1 -Interim guidelines for open-top container ships) - will also satisfy the requirement for dangerous goods.*

2 *The amount of water required for fire-fighting purposes in the largest hold should allow simultaneous use of the water spray system plus four jets of water from hose nozzles. (IACS UI SC109, MSC/Circ.1120)*

7.2.1.2 The quantity of water delivered shall be capable of supplying four nozzles of a size and at pressures as specified in sub-chapter 3.2 (SOLAS reg. 10.2), capable of being trained on any part of the cargo space when empty.* This amount of water may be applied by equivalent means to the satisfaction of the Administration. (SOLAS II-2/19.3.1.2)

***** ***IACS and IMO interpretation***

Hydrants for dangerous goods:

The number and position of hydrants should be such that at least two of the required four jets of water, when supplied by single lengths of hose, may reach any part of the cargo space when empty; and all four jets of water, each supplied by single lengths of hose may reach any part of ro-ro cargo spaces. (IACS UI SC168, MSC/Circ.1120).

See MSC.1/Circ.1320 – *Guidelines for the drainage of fire-fighting water from closed vehicle and ro-ro spaces and special category spaces of passenger and cargo ships.*

Note:
See interpretation for ships carrying five or more tiers of containers on open deck – see par. 11.2.3.2.4. (IACS UI SC270, MSC.1/Circ.1550)

7.2.1.3 Means shall be provided for effectively cooling the designated underdeck cargo space by at least 5 *l*/min per square meter of the horizontal area of cargo spaces, either by a fixed arrangement of spraying nozzles or flooding the cargo space with water*. Hoses may be used for this purpose in small cargo spaces and in small areas of larger cargo spaces at the discretion of the Administration. However, the drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces. The drainage system shall be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. 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 to the extent deemed necessary by the Administration in its approval of the stability information. (SOLAS II-2/19.3.1.3)

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.

Note:
* Interpretation – see sub-chapter 3.2.1.3 (IACS UI SC270, MSC.1/Circ.1550)

7.2.1.4 Provision to flood a designated under-deck cargo space with suitable specified media may be substituted for the requirements in par. 7.2.1.3 (SOLAS par. 19.3.1.3). (SOLAS II-2/19.3.1.4)

IMO interpretation

Acceptance of high expansion foam systems in case of dangerous goods:

A fixed high expansion foam system, complying with requirements of sec. 3.5.3 (FSS Code, chapter 6, section 2.2), is acceptable, except if cargoes dangerously react with water (see IMDG Code). (MSC/Circ.1120)

7.2.1.5 The total required capacity of the water supply shall satisfy par. 7.2.1.2 and 7.2.1.3 (SOLAS par. 19.3.1.2 and 19.3.1.3), if applicable, simultaneously calculated for the largest designated cargo space. The capacity requirements of par. 7.2.1.2 (SOLAS par. 19.3.1.2) 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 a drencher system is used to satisfy par. 7.2.1.3 (SOLAS par. 19.3.1.3), the drencher pump shall also be taken into account in this total capacity calculation. (SOLAS II-2/19.3.1.5)

7.2.2 Sources of ignition

Electrical equipment and wiring shall not be fitted in enclosed cargo spaces or vehicle spaces unless it is essential for operational purposes in the opinion of the Administration. 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 unless it is possible to completely isolate the electrical system (e.g. by removal of links in the system, other than fuses). Cable penetrations of the decks and bulkheads shall be sealed against the passage of gas or vapour. Through runs of cables and cables within the cargo spaces shall be protected against damage from impact. Any other equipment which may constitute a source of ignition of flammable vapour shall not be permitted. (SOLAS II-2/19.3.2)

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* Refer to the recommendations of the International Electrotechnical Commission, in particular, publication IEC 60092 on *Electrical installations in ships.*

**** IACS and IMO interpretation***

Certified Safe Type Electrical Equipment for Ships Carrying Dangerous Good:

1. *Reference is to be made to IEC 60092-506:2003.*
2. *For pipes having open ends (e.g. ventilation and bilge pipes, etc.) in a hazardous area, the pipe itself is to be classified as hazardous area. See IEC 60092-506:2003 table B1, item B.*
3. *When carrying flammable liquids having flashpoints less than 23°C as Class 3, 6.1 or 8 in cargo spaces, the bilge pipes with flanges, valves, pumps, etc. constitute a source of release and the enclosing spaces (e.g. pipe tunnels, bilge pump rooms, etc.) are to be classified as an extended hazardous area (comparable with Zone 2) unless these spaces are continuously mechanically ventilated with a capacity for at least six air changes per hour. Except where the space is protected with redundant mechanical ventilation capable of starting automatically, equipment not certified for Zone 2 are to be automatically disconnected following loss of ventilation while essential systems such as bilge and ballast systems are to be certified for Zone 2.*

   Where redundant mechanical ventilation is employed, equipment and essential systems not certified for Zone 2 shall be interlocked so as to prevent inadvertent operation if the ventilation is not operational. Audible and visible alarms shall be provided at a manned station if failure occurs. (IACS UI SC79, MSC.1/Circ.1555)

7.2.3 Detection system

Ro-ro spaces shall be fitted with a fixed fire detection and fire alarm system complying with the requirements of sub-chapter 4.1 (FSS Code). 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 sub-chapter 4.1 or 4.2 (FSS Code). If a sample extraction smoke detection system is fitted, particular attention shall be made to par. 4.2.2.5 (par. 2.1.3 in chapter 10 of FSS Code) in order to prevent the leakage of toxic fumes into occupied areas. (SOLAS II-2/19.3.3)

7.2.4 Ventilation arrangement

7.2.4.1 Adequate power ventilation shall be provided in enclosed cargo spaces. The arrangement shall be such as to provide for at least six air changes per hour in the cargo space based on an empty cargo space and for removal of vapours from the upper or lower parts of the cargo space, as appropriate. (SOLAS II-2/19.3.4.1)

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.

IACS and IMO interpretation

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 shall apply to the adjacent space as for the enclosed cargo space itself.

Where the IMSBC Code requires:

- *2 fans per hold, a common ventilation system with 2 fans connected is acceptable.*
- *continuous ventilation, this does not prohibit ventilators from being fitted with a means of closure as required for fire protection purposes under SOLAS II-2/5.2.1.1 provided the minimum height to the ventilator opening is to be in accordance with ICLL/19.3 (4.5m for Position 1 and 2.3m for Position 2). (IACS UI SC89, MSC.1/Circ.1434)*

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

For open top container holds:

Power ventilation is interpreted to be required only for the lower part of the cargo hold for which purpose ducting is required. The ventilation capacity is to be at least 2 air changes per hour based on the empty hold volume below weather deck. (IACS UI SC110, MSC/Circ.1120).

IACS interpretation

1. *The reduced air changes per hour as per Note 1 of Table 19.1 apply equally to the ventilation air change requirements in par. 7.2.4.1 and 7.2.5.4 (SOLAS Reg. II-2/19.3.4.1 and in SOLAS Reg. II-2/19.3.5.4), when the bilge pump is located directly inside a container cargo space.*
2. *In such a case, where several container cargo spaces are served by the same bilge pump, the bilge pump is to be installed in the container cargo space with the highest ventilation rate, compared to the other container cargo spaces. (IACS UI SC288)*

7.2.4.2 The fans shall be such as to avoid the possibility of ignition of flammable gas air mixtures. Suitable wire mesh guards shall be fitted over inlet and outlet ventilation openings*. (SOLAS II-2/19.3.4.2)

The ventilation outlets shall be located at a safe distance from potential sources of ignition. It is required that the radius of the sphere inside which it is forbidden to place any sources of ignition is at least 3 m.

**** IACS and IMO interpretation***

Degree of protection of exhaust fans and use of wire mesh guards:

1 *Exhaust fans are to be of non-sparking type in accordance with IACS Requirement F 29, as revised.*
2 *The purpose of "suitable wire mesh guards" is to prevent foreign objects from entering into the fan casing. The standard wire mesh guards are to have a size of 13 mm x 13 mm. (IACS UI SC52, MSC/Circ.1120)*

7.2.4.3 Natural ventilation 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. (SOLAS II-2/19.3.4.3)

7.2.4.4 On ships designed to carry five or more tiers of containers on or above the weather deck, it is recommended, that arrangements should be provided to permit a rapid shutdown and effective closure of the ventilation system from outside of the space, in case of fire and toxic smoke coming out from the vents, taking into account the weather and sea conditions.

Access routes to the controls for closure of the ventilation system shall be:

.1 clearly marked and at least 600 mm clear width;

.2 provided with a single handrail or wire rope lifeline not less than 10 mm in diameter, supported by stanchions not more than 10 m apart in way of any route which involves traversing a deck exposed to weather; and

.3 fitted with appropriate means of access (such as ladders or steps) to the closing devices of ventilators located in high positions (i.e. 1.8 m and above).

Alternatively, remote arrangement of closing devices and their position indicators shall be provided.

7.2.5 Bilge pumping

7.2.5.1 Where it is intended to carry flammable or toxic liquids in enclosed cargo spaces, the bilge pumping system* shall be designed to protect against inadvertent pumping of such liquids through machinery space piping or pumps. Where large quantities of such liquids are carried, consideration shall be given to the provision of additional means of draining those cargo spaces. (SOLAS II-2/19.3.5.1)

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* ***IACS interpretations***

For open top container holds:

Bilge systems for cargo holds should be independent of the machinery space bilge system and be located outside of the machinery space. (IACS UI SC111)

Interpretation regarding bilge pumping:

a) *Cargo spaces intended for carriage of flammable liquids with flash point less than 23 degrees C or toxic liquids shall be fitted with a fixed bilge drainage system independent or separated from the bilge system in machinery space and located outside of the machinery space.*

   If a single bilge drainage system completely independent of the machinery space is provided, the system is to comply with the Rule requirement to redundancy based on the size of the space or spaces which it services.

b) *Electrical equipment in the space containing bilge pumps serving cargo spaces intended for carriage of flammable or toxic liquids is to be according to unified interpretation SC79.* (IACS UI SC90)

7.2.5.2 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^3/h per cargo space served. If the additional system is common, the capacity need not exceed 25 m^3/h. The additional bilge system need not be arranged with redundancy. (SOLAS II-2/19.3.5.2)

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.

7.2.5.3 Whenever flammable or toxic liquids are carried, the bilge line into the machinery space shall be isolated either by fitting a blank flange or by a closed lockable valve. (SOLAS II-2/19.3.5.3)

The isolating valve shall be situated outside the machinery space, at the point of line exit from the machinery space close to the bulkhead.

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

7.2.5.4 Enclosed spaces outside machinery spaces containing bilge pumps serving cargo spaces intended for carriage of flammable or toxic liquids should be fitted with separate mechanical ventilation giving at least 6 air changes per hour*. If the space has access from another enclosed space, the door shall be self-closing. (SOLAS II-2/19.3.5.4)

***** *IMO interpretation***

Electrical equipment in the space should comply with IEC Publication 60092.- Electrical installations in ships. (MSC/Circ.1120)

Note:
See also interpretations to par. 7.2.4.1 (SOLAS reg. 19.3.4.1). (IACS UI SC288)

7.2.5.5 If bilge drainage 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. (SOLAS II-2/19.3.5.5)

7.2.6 Personnel protection

7.2.6.1 Four sets of full protective clothing resistant to chemical attack shall be provided in addition to the fire-fighter's outfits required by sub-chapter 6.7 (SOLAS reg. 10.10) and shall be selected taking into account the hazards associated with the chemicals being transported and the standards developed by Organization according to the class and physical state*. The protective clothing shall cover all skin, so that no part of the body is unprotected. (SOLAS II-2/19.3.6.1)

***** *IACS and IMO interpretation***

a) The required protective clothing is for emergency purposes.

b) For solid bulk cargoes the protective clothing is to satisfy the equipment requirements specified in Appendix 1 of the IMSBC Code for the individual substances. For packaged goods the protective clothing is to satisfy the equipment requirements specified in emergency procedures (EmS) of the Supplement to IMDG Code for the individual substances. (IACS UI SC91, MSC/Circ.1120)

7.2.6.2 At least two self-contained breathing apparatuses additional to those required by sub-chapter 6.7 (SOLAS reg. 10) shall be provided. Two spare charges suitable for use with the breathing apparatus shall be provided for each required apparatus*. Passenger ships carrying not more than 36 passengers and-cargo ships that are equipped with suitably located means for fully recharging the air cylinders free from contamination, need carry only one spare charge for each required apparatus. (SOLAS II-2/19.3.6.2)

***** *IACS interpretation***

For each of the breathing apparatuses, two complete sets of air bottles are required. These spare bottles are to be in addition to the spare bottles required for fireman's outfit. (IACS UI SC92)

7.2.7 Portable fire extinguishers*

Note:
* The arrangement of fire-extinguishers – see sub-chapter 5.2.3.

Portable fire extinguishers with a total capacity of at least 12 kg of dry powder or equivalent shall be provided for the cargo spaces. These extinguishers shall be in addition to any portable fire extinguishers required elsewhere in this *Part V* (chapter). (SOLAS II-2/19.3.7)

7.2.8 Insulation of machinery space boundaries*

Bulkheads forming boundaries between cargo spaces and machinery spaces of category A shall be insulated to "A-60" class standard, unless the dangerous goods are stowed at least 3 m horizontally away from such bulkheads. Other boundaries between such spaces shall be insulated to "A-60" class standard. (SOLAS II-2/19.3.8)

**** IACS interpretation***

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, dangerous goods are prohibited in the whole of that cargo space. If the uninsulated deck above the machinery space is a weather deck, dangerous goods are prohibited only for the portion of the deck located above the machinery space. (IACS UI SC103)

7.2.9 Water spray system in ro-ro spaces

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 an approved fixed pressure water-spraying system for manual operation which shall protect all parts of any deck and vehicle platform in the space, except that the Administration may permit the use of any other fixed fire-extinguishing system that has been shown by full-scale test to be no less effective. However, the drainage and pumping arrangements shall be such as to prevent the build-up of free surfaces. The drainage system shall be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The drainage system valves shall be operable from outside the protected space at a position in the vicinity of the extinguishing system controls. 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 to the extent deemed necessary by the Administration in its approval of the stability information. (SOLAS II-2/19.3.9)

7.2.10 Separation of ro-ro spaces

7.2.10.1 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. Alternatively, such separation need not be provided if the ro-ro space is considered to be a closed cargo space over its entire length and shall fully comply with the relevant special requirements of this chapter 7 (regulation). (SOLAS II-2/19.3.10.1)

7.2.10.2 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. Alternatively, a separation need not be provided if the arrangements of the closed ro-ro spaces are in accordance with those required for the dangerous goods carried on adjacent weather deck. (SOLAS II-2/19.3.10.2)

7.3 Document of compliance*

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* Refer to the *Document of compliance with the special requirements for ships carrying dangerous goods under the provisions of reg. II-2/19 of SOLAS 74, as amended*, and par. 7.17 of the *2000 HSC Code*, as amended (MSC.1/Circ.1266).

The Administration shall provide the ship with an appropriate document as evidence of compliance of construction and equipment with the requirements of this chapter 7 (regulation). Certification for dangerous goods*, except solid dangerous goods in bulk, is not required for those cargoes specified as class 6.2 and 7 and dangerous goods in limited quantities and excepted quantities. (SOLAS II-2/19.4)

**** IACS and IMO interpretation***

Certification for carriage of solid dangerous bulk cargoes covers only those cargoes listed in Group B in the IMSBC Code except cargoes classified solely as MHB. Other solid dangerous bulk cargoes may only be permitted subject to acceptance by the Administrations involved. (IACS UI SC87, MSC/Circ.1120)

Table 19.1
Application of the requirements to different modes of carriage of dangerous goods in ships and cargo spaces

Where X appears in the Table 19.1, it means this requirement is applicable to all classes of dangerous goods as given in the appropriate line of Table 19.3, except as indicated by the notes.

Paragraph – 7.1.2 / Paragraph		.1	.2	.3		.4	.5
	Weather decks of ships listed in 1. to 5.	Not specially designed	Container cargo spaces	Closed ro-ro spaces [5]	Open ro-ro spaces*	Solid dangerous goods in bulk	Shipborne barges
7.2.1.1	X	X	X	X	X	For application of requirements of chapter 7 to different classes of dangerous goods, see Table 19.2	X
7.2.1.2	X	X	X	X	X		–
7.2.1.3	–	X	X	X	X		X
7.2.1.4	–	X	X	X	X		X
7.2.2	–	X	X	X	X		X[4]
7.2.3	–	X	X	X	–		X[4]
7.2.4.1	–	X	X[1]	X	–		X[4]
7.2.4.2	–	X	X[1]	X	–		X[4]
7.2.5	–	X	X	X	–		–
7.2.6.1	X	X	X	X	X		–
7.2.6.2	X	X	X	X	X		–
7.2.7	X	X	–	–	X		–
7.2.8	X	X	X[2]	X	X		–
7.2.9	–	–	–	X[3]	X		–
7.2.10.1	–	–	–	X	–		–
7.2.10.2	–	–	–	X	–		–

Notes:

[1] For classes 4 and 5.1 solids not applicable to closed freight containers. For classes 2, 3, 6.1 and 8 when carried in closed freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For classes 4 and 5.1 liquids when carried in closed freight containers, the ventilation rate may be reduced to not less than two air changes per hour. For the purpose of this requirement, a portable tank is a closed freight container.

See also interpretations to par. 7.2.4.1 (SOLAS reg. 19.3.4.1). (IACS UI SC288)

2 Applicable to decks only.

3 Applies only to closed ro-ro spaces, not capable of being sealed.

4 In the special case where the barges are capable of containing flammable vapours or alternatively if they are capable of discharging flammable vapours to a safe space outside the barge carrier compartment by means of ventilation ducts connected to the barges, these requirements may be reduced or waived to the satisfaction of the Administration.

5 Special category spaces shall be considered as closed ro-ro spaces when dangerous goods are carried.

Table 19.2
Application of the requirements to different classes of dangerous goods for ship and cargo spaces carrying solid dangerous goods in bulk

Class / Paragraph	4.1	4.2	4.3[6)]	5.1	6.1	8	9
7.2.1.1	X	X	–	X	–	–	X
7.2.1.2	X	X	–	X	–	–	X
7.2.2	X	X[7)]	X	X[8)]	–	–	X[8)]
7.2.4.1	–	X[7)]	X	–	–	–	–
7.2.4.2	X[9)]	X[7)]	X	X[7),9)]	–	–	X[7),9)]
7.2.4.3	X	X	X	X	X	X	X
7.2.6	X	X	X	X	X	X	X
7.2.8	X	X	X	X[7]	–	–	X[10)]

Notes:

6 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.

7 Only applicable to Seedcake containing solvent extractions, to Ammonium nitrate and to Ammonium nitrate fertilizers.

8 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.

9 Only suitable wire mesh guards are required.

10 The requirements of the *IMSBC Code* are sufficient.

Table 19.3
Application of the requirements to different classes of dangerous goods except solid dangerous goods in bulk

Paragraph \ Class	1.1 to 1.6	1.4 S	2.1	2.2	2.3 flammable[20]	2.3 non-flammable	3 FP[15] < 23 °C	3 FP[15] ≥ 23 °C to ≤ 60 °C	4.1	4.2	4.3 liquids[21]	4.3 solids	5.1	5.2[16]	6.1 liquids FP[15] < 23 °C	6.1 liquids FP[15] ≥ 23 °C to ≤ 60 °C	6.1 liquids	6.1 solids	8 liquids FP[15] < 23 °C	8 liquids FP[15] ≥ 23 °C to ≤ 60 °C	8 liquids	8 solids	9 miscellaneous
7.2.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.2.1.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	–
7.2.1.3	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7.2.1.4	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7.2.2	X	–	X	–	X	–	X	–	–	–	X[18]	–	–	–	X	–	–	–	X	–	–	–	X[17]
7.2.3	X	X	X	X	–	X	X	X	X	X	X	X	X	–	X	X	X	X	X	X	X	X	–
7.2.4.1	–	–	X	–	–	X	X	–	X[11]	X[11]	X	X	X[11]	–	X	X	–	X[11]	X	X	–	–	X[11]
7.2.4.2	–	–	X	–	–	–	X	–	–	–	–	–	–	–	X	–	–	–	X	–	–	–	X[17]
7.2.5	–	–	–	–	–	–	X	–	–	–	–	–	–	–	X	X	X	–	X	X[19]	X[19]	–	–
7.2.6	–	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[14]
7.2.7	–	–	–	–	–	–	X	X	X	X	X	X	X	–	X	X	–	–	X	X	–	–	–
7.2.8	X[12]	–	X	X	X	X	X	X	X	X	X	X	X[13]	X	X	X	–	–	X	X	–	–	–
7.2.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.2.10.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7.2.10.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:

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

CHAPTER 8

8 REQUIREMENTS FOR APPLIANCES AND EQUIPMENT POSING ADDITIONAL RISK OF FIRE ON BOARD SHIPS

8.1 Store rooms for flammable liquids with a flash-point lower than 43°C

8.1.1 Flammable liquids with a flash-point lower than 43°C, as 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 equipped with:

- **.1** self-closing valve for liquid intake;
- **.2** closed type level indicator;
- **.3** pipe for filling the receiver from outside of the store-room;
- **.4** vent pipes led out to the open deck, terminated with an approved type head with an anti-spark net;
- **.5** drip tray.

If the amount of flammable liquid does not exceed 35 *l*, it is allowed to store it in metal canisters with tight closure.

If the total volume of the receivers exceeds 250 *l* (but does not exceed 2500 *l*), the store-room used for their storage shall be equipped with an independent mechanical exhaust ventilation system, ensuring the removal of air from the lower parts of the room with an exchange rate of not less than 20 per hour.

Supply ventilation may be natural.

The switching on of the fans shall be interlocked with the device opening the entrance door to the store-room. All equipment in this store-room space shall be explosion-proof, meeting the requirements specified in *Part VIII,* sub-chapter 2.8.

Ife the amount of flammable liquids exceeds 2500 *l*, the tanks for their storage shall fulfil the requirements specified in 8.3.

8.1.2 In ships of less than 300 gross tonnage, where it is not possible to separate a special store for flammable liquids with flash-point below 43°C, the liquids can be stored in ventilated steel cabinets or boxes. Such cabinets or boxes shall not be adjacent to accommodation spaces and their doors shall open outwards.

Inside the cabinets or boxes, liquids should be stored in metal canisters with tight closures, and their total capacity should not exceed 50 *l*.

8.2 Tanks and distributing fuel stations with a flash point lower than 43°C

8.2.1 Tanks intended for fuel with a flash point lower than 43°C, as determined by an approved apparatus (close-cup test), shall comply with the following requirements:

- **.1** they shall be located in the ship's hull and as close as possible to the bow or stern;
- **.2** they shall be surrounded on all sides and corners, excluding the side below the lowest waterline, with cofferdams which, in service conditions, shall be filled with inert gas. Air pipes of this cofferdams shall fulfil the requirements specified in, *Part VII,* sub-chapter 9.1. Cofferdams shall be fitted with sounding pipes led out to the open deck;
- **.3** each fuel tank shall be fitted with pipes: filling, fuel discharge, sounding and air pipes. The lower end of filling pipe shall be situated not more than 0.3 m, and the lower end of sounding pipe not more than 30 mm from the bottom of the tank. It is recommended to use closed-type level indicator, instead of the sounding pipes;

.4 air pipes of the tank shall be extend 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 anti-spark mesh;
.5 all fuel tank pipes shall be led from the tanks to the fuel station inside a separate gas-tight trunk, sized to provide access along the entire length of the trunk. The trunk walls shall be constructed as "A-60" class structure, and if the trunk is to be filled with water or inert gas, "A-0" class is sufficient. In case of open trunks, the supply and exhaust ventilation of the trunk shall be provided. The outlets of ventilation pipes shall be fitted with anti-spark mesh;
.6 to avoid the formation of electrostatic charges, all fuel pipelines, machinery, fittings and instruments related to fuel storage and transport shall be electrically grounded to the ship's hull structure.

8.2.2 Distribution fuel stations with a flash point lower than 43°C shall fulfil the following requirements:
.1 they shall be located on the open deck as far as possible from accommodation spaces and places where the source of fire may be expected;
.2 they shall be enclosed with "A-60" class divisions. The door may be "A" class steel door without insulation. Walls and decks of the station should be gastight;
.3 deck coverings, 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 fuel to a suitable drain tank.

8.3 Cylinders containing welding gases (oxygen or acetylene)

8.3.1 General requirements

8.3.1.1 Cylinders containing welding gases shall be delivered with appropriate certificate.

8.3.1.2 The cylinders shall be fitted with caps protecting the cylinder valve.

8.3.1.3 The storage of cylinders containing oxygen or acetylene in machinery spaces is prohibited.

8.3.2 Cylinder storage room

8.3.2.1 Cylinders containing welding gases shall be stored in a room specially designated for this purpose, which meets the following requirements:
.1 storage room shall be located on the open deck, with door which opens only to the open deck;
.2 the room shall be surrounded by "A-0" class divisions and separated from the fire-hazardous adjacent spaces by "A-60" class divisions;
.3 no electrical systems or equipment shall be installed in the room, except equipment necessary to operate the room. If electrical equipment is installed, it should be explosion-proof;
.4 separate room shall be provided for the storage of cylinders containing each type of gas;
.5 cylinder storage room must not be used for any purposes other than the storage of gas cylinders;
.6 the room shall be provided with an effective ventilation system;
.7 on the door to the room there shall be signs: NO SMOKING and DANGER OF EXPLOSION. DO NOT ENTER WITH NAKED FLAME;

.8 safety manual containing the following information shall be provided in the room:
- after finishing work, all cylinders valves shall be closed;
- there must be no flammable materials in the vicinity of the oxygen cylinder (especially in the form of oil and fat);
- cylinder valves must not be operated with oily or greasy hands.

8.3.2.2 The cylinders, including empty cylinders, shall be stored in an upright position, securely fastened to enable their easy removal. Cylinders shall be labelled with the name and chemical formula of the stored gas.

8.3.2.3 Cylinders shall be placed on a base made of wood or other similar material in such a way that will not be in direct contact with the deck surface.

8.3.3 Storage of the cylinders on open deck

Cylinders containing welding gases – not more than two such cylinders – may be stored on open decks in a place specially designated for this purpose. This place shall meet the following requirements:

.1 it is to be at a distance of at least 10 m from accommodation spaces and control stations and at least 4 m from the rooms where flammable materials are stored;

.2 shall be protected against heating and the effects of weather conditions, as well as against the possibility of their mechanical damage;

.3 the place shall be marked with the following notices NO SMOKING and DANGER OF EXPLOSION. THE USE OF OPEN FLAME IS PROHIBITED.

8.3.4 Welding gases systems

8.3.4.1 The pipes supplying oxygen and acetylene to a welding shop shall be made of steel and joined with welded couplings or flanges.

8.3.4.2 Each pipeline shall be fitted with pressure reducing valve and shut-off valve.

8.3.4.3 If two or more cylinders are connected to the manifold, non-return valves shall be fitted in the supply pipeline between the cylinders.

8.3.4.4 The cylinders shall be connected to the manifold by means of approved type flexible pipes.

8.3.4.5 The manifold shall be fitted with a safety valve. The outlet from the safety valve shall be led to the open deck, in a safe place, not posing fire hazard.

8.3.4.6 After installation on board, the system is subject to acceptance and tests in accordance with the approved documentation. The pipes are subject to a strength tightness test, with a test pressure of at least 1.25 of oxygen and acetylene working pressure.

8.4 Heating of ship spaces

8.4.1 Electric heating system of ship spaces shall comply with the requirements specified in, *Part VIII,* Chapter 15.

8.4.2 Electric radiators, if used, shall be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiators shall be fitted with an element so exposed that clothing, curtains, or other similar materials can be scorched or set on fire by heat from the element. (SOLAS II-2/4.4.1)

8.4.3 It is prohibited to use open flame heating appliances, such as solid fuel (coal) or gas fired heating stoves with open burners.

8.5 Gaseous fuel system for domestic purposes

The system shall comply with requirements specified in sub-chapter 8.11 of *Part VI.*

8.6 Additional fire safety measures related to the Installation of ballast water management systems (BWMS) on-board ships

IACS UR F45

8.6.1 General (1)

8.6.1.1 Application (1.1)

8.6.1.1.1 This sub-chapter 8.6 (Unified Requirement) details fire safety measures, in addition to that required by this *Part V* (SOLAS II-2), related to the installation of Ballast Water Management Systems onboard any ship.

This sub-chapter (UR) is to be read in conjunction with sec. 4.5.4 of *Part VI* (IACS UR M74 rev.2 - Ballast Water Management Systems). (1.1.1)

8.6.1.1.2 The requirements of this sub-chapter (UR) apply for BWMS technologies as listed in Table 1. BWMS with alternative technologies are to be specially considered by the Classification Society. (1.1.2)

8.6.1.2 Definitions (1.2)

For the purposes of this sub-chapter 8.6, the following definitions apply:

8.6.1.2.1 Airlock

An airlock is a space enclosed by gastight steel bulkheads with two gastight doors spaced not more than 2.5 m apart. The doors shall be self-closing without any holding back arrangements. Air locks shall have mechanical ventilation and shall not be used for other purposes. An audible and visual alarm system to give a warning on both sides of the air lock shall be provided to indicate if more than one door is moved from the closed position. The air lock space shall be monitored for dangerous gas as defined in sec. 4.5.4 of *Part VI* (UR M74 §2.3). (1.2.1)

8.6.1.2.2 Ballast Water Management System (BWMS)

Ballast Water Management System means any system defined in sec. 4.5.4 of *Part VI* (in par. 2.1 UR M74, Rev.2). (1.2.2)

Table 1 – Categorization of BWMS technologies

BWMS's Technology category* →		1	2	3a	3b	3c	4	5	6	7a	7b	8
Characteristics ↓		n-line UV or UV + Advanced Oxidation Technology (AOT) or UV + TiO_2 or UV + Plasma+ TiO_2	In-line Flocculation	In-line membrane separation and de-oxygenation (injection of N2 from a N2 Generator)	In-line de-oxygenation (injection of Inert Gas from Inert Gas Generator)	In-tank de-oxygenation with Inert Gas Generator	In-line full flow electrolysis	In-line side stream electrolysis (2)	In-line (stored) chemical injection	In-line side-stream ozone injection without gas/liquid separation tank and without Discharge treatment tank	In-line side-stream ozone injection with gas/liquid separation tank and Discharge water treatment tank	In-tank pasteurization and de-oxygenation with N2 generator
Des-infection when ballasting	Making use of active substance		X			In-tank technology: No treatment when ballasting or de-ballasting	X	X	x	X	X	In-tank technology: No treatment when ballasting or de-ballasting
	Full flow of ballast water is passing through the BWMS	X	X	X	X		X				X	
	Only a small part of ballast water is passing through the BWMS to generate the active substance							X				
After-treatment when de-ballasting	Full flow of ballast water is passing through the BWMS	X									X	
	Injection of neutralizer						X	X	X	X	X	
	Not required by the Type Approval Certificate issued by the Administration		X	X								
Examples of dangerous gas as defined in UR M74 §2.3			(1)	O_2 N_2	CO_2 CO		H_2 Cl_2	H_2 Cl_2	(1)	O_2 O_3 N_2		O_2 N_2

Notes:
(1) To be investigated on a case by case basis based on the result of the IMO (GESAMP) MEPC report for Basic and Final approval in accordance with the G9 Guideline.
(2) In-line side stream electrolysis may also be applied in-tank in circulation mode (no treatment when ballasting or de-ballasting.

Footnote: * Taking into consideration future developments of BWMS technologies, some additional technologies may be considered in this Table 1 by identifying their characteristics in the same manner as for the above BWMS cat.1, 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8.

8.6.1.2.3 Ballast Water Management Room (BWMR)

A Ballast Water Management Room is any space containing equipment belonging to the Ballast Water Management System. A space containing remote controls for the BWMS or a space dedicated to the storage of liquid or solid chemicals for BWMS need not be considered as a BWMR for the purposes of this sub-chapter 8.6 (UR). (1.2.3)

8.6.1.2.4 BWMS storing, introducing or generating chemicals.

In general, BWMS storing, introducing or generating chemicals refer to:
– In-line flocculation (cat.2 as per Table 1),
– Chemical injection (cat.6 as per Table 1) and
– BWM technologies using neutralizers injection (cat.4, 5, 6 and 7 as per Table 1)

BWMS that do not store, introduce or generate toxic or flammable chemicals may be specially considered as detailed in Table 2 below.

Table 2: Requirements that may be reduced for BWMS storing, introducing or generating chemicals depending on the chemicals.

Requirement	Conditions to be met before reducing the requirement
8.6.2.3.4 (2.3.4)	The stored chemicals are neither toxic nor flammable
8.6.3.1.1 (3.1.1)	The BWMS does not use any flammable or toxic chemical substances
8.6.3.3.1 (3.3.1)	No dangerous gas as defined in UR M74 §2.3 will be generated by the BWMS
8.6.6.1.1 (6.1.1)	No toxic chemical is stored and no toxic gas will be generated by the BWMS
8.6.7.1.1 (7.1.1) 8.6.7.1.3 (7.1.3) 8.6.7.1.6 (7.1.6)	No toxic chemical is used or will be generated by the BWMS

The IMO reports issued during the basic and final approval procedures of the BWMS that make use of active substances (G9 Guidelines) and ''safety hazard'' as listed in Ch.17 of IMO IBC code are to be considered for this purpose.

Note: Chemicals include additives for BWMS (1.2.4)

8.6.2 Fire categorization (2)

8.6.2.1 General (2.1)

BWMR shall be classified as follows for the purpose of applying the requirements of this *Part V* (SOLAS Chapter II-2):
• BWMR containing oil-fired inert gas generators (i.e. BWMS cat.3b and 3c as per Table 1) shall be treated as machinery spaces of category A;
• Other BWMR shall be considered as other machinery spaces and shall be categorized, depending on the ship type (10) or (11) – for passenger ships > 36 pas., according to, sec. 11.1.2.3 (SOLAS II-2/9.2.2.3) or (7) – for other ships, according to sec. 11.1.2.2.4, 2.2.2.2.2 and 11.6.3.2.2.2 (SOLAS II-2/9.2.2.4, II-2/9.2.3 and II-2/9.2.4). (2.1)

8.6.2.2 BWMS located in the cargo area of tankers

Notwithstanding the above, where a BWMS is located in the cargo area of a tanker as allowed by sec. 4.5.4 of *Part VI* (UR M74), the BWMR shall be categorized as (8), a cargo pump-room, according to, sec. 11.6.3.2.2 (SOLAS II-2/9.2.4.2.2) for determining the extent of fire protection to be provided.

Note: The cargo area of a tanker is defined in sec. 4.5.4 of *Part VI* (para 2.2 of UR M74 Rev.2). (2.2)

8.6.2.3 Storage of chemicals

8.6.2.3.1 Spaces where the storage of liquid or solid chemicals for BWMS is intended shall be categorized as store-rooms for the purpose of applying the requirements of this *Part V* (SOLAS Chapter II-2), i.e.:

- On passenger ships carrying more than 36 passengers:
  – "Other spaces in which flammable liquids are stowed" as defined in par. 11.1.2.3.2.2(14) (SOLAS II-2/9.2.2.3.2.2(14)), if flammable products are stored
  – "Store-rooms, workshops, pantries, etc." as defined in par. 11.1.2.3.2.2(13) (SOLAS II-2/9.2.2.3.2.2(13)) otherwise
- On other ships:
  – "Cargo pump-rooms" as defined in par. 11.6.3.2.2.2(8) (SOLAS II-2/9.2.4.2.2.2(8)) if located in the cargo area of a tanker;
  – "Service spaces (low risk)" as defined in par. 11.1.2.2.4.2(5) (SOLAS II-2/9.2.2.4.2.2(5)), in par. 2.2.2.2.2(5) (SOLAS II-2/9.2.3.3.2.2(5)) or in par. 11.6.3.2.2.2(5) (SOLAS II-2/9.2.4.2.2.2(5)) if the surface area is less than 4m^2 and if no flammable products are stored;
  – "Service spaces (high risk)" as defined in par. 11.1.2.2.4.2(9) (SOLAS II-2/9.2.2.4.2.2(9)), par. 2.2.2.2.2(9) (SOLAS II-2/9.2.3.3.2.2(9)) or in par. 11.6.3.2.2.2(9) (SOLAS II-2/9.2.4.2.2.2(9)) otherwise

Note: It is understood that only chemical injection (cat.6 as per Table 1), in-line flocculation (cat.2 as per Table 1) and technologies using neutralizer injection (cat.4, 5, 6 and 7 as per Table 1) will require chemical or additive storage. (2.3.1)

8.6.2.3.2 Where the storage of chemicals is foreseen in the same room as the ballast water management machinery, this room shall be considered both as a store-room and as a machinery space in line with 8.6.2.1 (UR, par. 2.1). (2.3.2)

8.6.2.3.3 When the chemical substances are stored inside integral tanks, the ship's shell plating shall not form any boundary of the tank. (2.3.3)

8.6.2.3.4 Tanks containing chemicals shall be segregated from accommodation, service spaces, control stations, machinery spaces not related to the BWMS and from drinking water and stores for human consumption by means of a cofferdam, void space, cargo pump-room, empty tank, oil fuel storage tank, BWMR or other similar space. On-deck stowage of permanently attached deck tanks or installation of independent tanks in otherwise empty hold spaces should be considered as satisfying this provision. (2.3.4)

8.6.3 BWMR location and boundaries (3)

8.6.3.1 BWMS using chemical substances (3.1)

8.6.3.1.1 For BWMS storing, introducing or generating chemicals, the BWMR and chemical substance storage rooms are not to be located in the accommodation area. Any ventilation exhaust or other openings from these rooms shall be located not less than 3m from entrances, air inlets and openings to accommodation spaces. This requirement need not apply in case the BWMS is located in the engine room. (3.1.1)

8.6.3.2 Ozone-based BWMS (3.2)

8.6.3.2.1 Ozone-based BWMS – i.e. cat.7a and 7b - shall be located in dedicated compartment, separated from any other space by gastight boundaries. Access to the BWMR from any other enclosed space shall be through airlock only, except if the only access to that space is from the open deck.

Access to the ozone based BWMR may be provided through the engine room only provided:
- Access from the engine room to the BWMR is through airlock and,
- An alarm repeater is provided in the BWMR, which will repeat any alarm activated in the engine room. (3.2.1)

8.6.3.2.2 A sign shall be affixed on the door providing personnel with a warning that ozone may be present and with the necessary instructions to be followed before entering the room. (3.2.2)

8.6.3.3 General (3.3)

8.6.3.3.1 BWMR containing equipment for BWMS of the following types shall be equipped with tested gastight and self-closing doors without any holding back arrangements:
- BWMS storing, introducing or generating chemical substances
- De-oxygenation based on inert gas generator
- Electrolysis
- Ozone injection

Doors leading to the open deck need however not to be self-closing. (3.3.1)

8.6.4 Fire fighting (4)

8.6.4.1 Fixed fire-extinguishing system (4.1)

8.6.4.1.1 Where fitted, fixed fire extinguishing systems shall comply with the relevant provisions of chapter 3 (FSS Code). (4.1.1)

8.6.4.1.2 Ozone-based BWMS

BWMR containing equipment related to ozone-based BWMS shall be provided with a fixed fire extinguishing system suitable for category A machinery spaces and capable of manual release. (4.1.2)

8.6.4.1.3 Where a fixed fire-extinguishing system is provided in the BWMR, it should be compatible with the BWMS and the chemical products that are used, produced or stored in the BWMR. Specific attention shall be paid to potential chemical reactions between the fire extinguishing medium and chemical products used for water treatment.

Especially, water-based fire-extinguishing systems should be avoided in case of sulfuric acid storage. (4.1.3)

8.6.4.1.4 Foam fixed fire-extinguishing system

For all kinds of BWMS, in case a foam fire extinguishing system is installed in the BWMR, its efficiency shall not be impaired by chemicals used by the BWMS where relevant. (4.1.4)

8.6.4.1.5 Where a fixed fire-extinguishing system is installed in the BWMR, automatic shutdown of the BWMS upon release of the fixed fire extinguishing system shall be arranged. Any need for cooldown necessary for safe shutdown to be considered in the shutdown sequence. (4.1.5)

8.6.4.1.6 Where BWMS that includes air or O_2 storage is located in a room covered by a fixed gas fire-extinguishing system, air or O_2 storage shall be taken into account for the gas capacity calculation, unless the discharge pipe from safety valves for air or O_2 storage are led directly to outside the room. (4.1.6)

8.6.4.2 Portable fire-fighting equipment (4.2)

8.6.4.2.1 There shall be at least one portable fire extinguisher that complies with the provisions of sub-chapter 5.2 (FSS Code) and suitable for electrical fires in the BWMR containing UV-type BWMS. (4.2.1)

8.6.5 Fire prevention (5)

8.6.5.1 Equipment protection (5.1)

8.6.5.1.1 Overcurrent or overvoltage protection is to be installed to protect UV type BWMS. (5.1.1)

8.6.5.1.2 Electrolysis reactors are to be provided with at least with two independent means of monitoring operation. The monitoring system shall initiate audible and visual alarms and automatic shutdown of the BWMS in the event that an anomaly is detected. Requirements for shutdown arrangement are clarified in sec. 4.5.4 of *Part. VI* (UR M74, par. 3.1.9).

Note: If a pressure relief valve is also provided, the vent of this valve is to be led to a safe location on the open deck, as clarified in sec. 4.5.4 of *Part VI* (UR M74). The valve should be positioned to optimally remove gas from the electrolysis reactor. (5.1.2)

8.6.5.2 Fire detection (5.2)

8.6.5.2.1 A fixed fire detection and fire alarm system complying with the provisions of sub-chapter 4.1 (FSS Code) shall be installed in spaces containing an inert gas generator or an ozone generator. (5.2.1)

8.6.5.2.2 A section of fire detectors which covers a control station, a service space or an accommodation space is not to include a BWMR containing equipment related to ozone based BWMS. (5.2.2)

8.6.6 Ventilation (6)

8.6.6.1 Ventilation arrangement (6.1)

8.6.6.1.1 The ventilation systems for BWMR containing BWMS of the following types shall be independent of the ventilation systems serving any other spaces:
- BWMS storing, introducing or generating chemical substances;
- De-oxygenation, including pasteurization and de-oxygenation (cat.3 and cat.8 as per Table 1);
- Electrolysis;
- Ozone injection. (6.1.1)

8.6.6.1.2 The ventilation exhaust for BWMR containing a nitrogen generator shall be located in the lower part of the room in order to efficiently evacuate dangerous gases – as defined in sec. 4.5.4 of *Part VI* (UR M74 §2.3) heavier than air. (6.1.2)

8.6.6.1.3 The ventilation exhaust for BWMR containing electrolysis systems shall be located so as to be able to efficiently evacuate dangerous gases – as defined in sec. 4.5.4 of *Part VI* (UR M74 §2.3) - that could be generated during the electrolysis process. Due regard shall be paid to the expected quantity and density of such gases when designing the ventilation exhaust. (6.1.3)

8.6.6.1.4 The following requirements apply to ventilation ducts serving BWMR for ozone-based BWMS:

- The part of the ducts located outside of the BWMR shall be made of steel having a thickness of at least 3 mm for ducts with a free cross-sectional area of less than 0.075 m², at least 4 mm for ducts with a free cross-sectional area of between 0.075 m² and 0.45 m², and at least 5 mm for ducts with a free cross-sectional area of over 0.45 m²; and
- The ducts shall be suitably supported and stiffened
- The outside openings of the ducts shall be fitted with protective screens of not more than 13 mm square mesh. (6.1.4)

8.6.6.1.5 The ventilation system for BWMR containing ozone-based BWMS or ventilation system for hydrogen de gas arrangement as required by sec. 4.5.4 of *Part VI* (UR M74 3.3.1.5) shall be interlocked with the BWMS such that:

- In case of loss of ventilation (primary and secondary), a visual and audible alarm shall be triggered both inside and outside the BWMR and at a place where a responsible member of the crew is on duty. If the ventilation is not restored after a pre-set time, the BWMS shall then be automatically shut down. Any need for cooldown necessary for safe shutdown is to be considered in the shutdown sequence;
- It shall not be possible to start the BWMS without the ventilation running.

For ventilation systems serving BWMR and containing or conveying a dangerous gas, relevant requirements in sec. 4.5.4 of *Part VI* (UR M74, par. 3.3) are to be satisfied. (6.1.5)

8.6.6.2 Ventilation rate (6.2)

8.6.6.2.1 An adequate power ventilation system shall be provided in enclosed BWMR. (6.2.1)

8.6.6.2.2 The ventilation capacity shall be at least 30 air changes per hour where explosive or toxic gases may be generated during operation of the BWMS. The IMO reports issued during the basic and final approval procedures of the BWMS that make use of active substances (G9 Guidelines) and ''safety hazard'' as listed in Ch.17 of IBC code are to be used as references for identifying those cases. (6.2.2)

8.6.6.2.3 The ventilation capacity may be reduced as follows:

• Flocculation-type BWMS	6 air changes per hour;
• De-oxygenation, incl. pasteurization and de-oxygenation (cat.3 and cat.8 as per Table 1)	6 air changes per hour;
• Full flow electrolysis	6 air changes per hour;
• Side-stream electrolysis	20 air changes per hour;
• Ozone injection	20 air changes per hour;
• Chemical injection	6 air changes per hour

Note: More stringent ventilation capacity requirements may arise from other regulations e.g. IBC Code requirements for spaces located in the cargo area. (6.2.3)

8.6.7 Personal equipment (7)

8.6.7.1 Suitable protection equipment shall be available onboard for the protection of the crew members who are engaged in the servicing, maintenance and repair of BWMS storing, introducing or generating chemicals, as recommended by the product manufacturers. The protection equipment shall consist of large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical-resistant materials, and tight fitting goggles or face shields or both. The protective clothing and equipment shall cover all skin so that no part of the body is unprotected. This protection equipment is to be provided separately without taking into account equipment required by other mandatory requirements. (7.1.1)

8.6.7.2 Work clothes and protective equipment shall be kept in easily accessible places and in special lockers. Such equipment shall not be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. Notwithstanding the above, storage rooms for such equipment within accommodation spaces if adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc. (7.1.2)

8.6.7.3 When a BWMS storing, introducing or generating chemicals is installed on board, suitably marked decontamination showers and an eyewash shall be available in a convenient location in close proximately to the BWMS and the chemical store room(s). (7.1.3)

8.6.7.4 An emergency escape breathing apparatus (EEBD) is to be provided in the BWMR. This emergency escape breathing apparatus may be one of the EEBDs provided in accordance with the requirements of sec. 2.3 or 11.1.7 (SOLAS II-2/13).

An EEBD need not be required for BWMS of cat.1 as per Table 1. (7.1.4)

8.6.7.5 A personal ozone detector, calibrated as per the manufacturer's specifications, shall be provided for each person engaged in the servicing, maintenance and repair of BWMS utilizing ozone. (7.1.5)

8.6.7.6 A two-way portable radiotelephone apparatus dedicated for the BWMS service, maintenance and repair shall be provided, in addition to those required by par.6.7.4 (SOLAS) for fire-fighting purposes. This two-way radiotelephone apparatus is to be properly identified in order to avoid mix-up with the apparatus intended for fire-fighting operations. Where the BWMS may release explosive gases, this two-way radiotelephone apparatus shall be of a certified safe type suitable for use in zone 1 hazardous areas, as defined in IEC Publication 60079.Where the BWMS stores, utilizes or introduces chemicals, the apparatus shall undergo deep cleaning or de-contamination after use.

A two-way portable radiotelephone apparatus need not be required for BWMS of cat.1 as per Table 1. (7.1.6)

END OF IACS UR F45

CHAPTER 9

9 REQUIREMENTS FOR THE SAFETY OF CARGO VESSELS OF LESS THAN CONVENTION SIZE

IACS REC. 99 (EXCERPTS)

9.1 Application

9.1.1 The requirements specified in this chapter 9 apply to cargo vessels including tugs, dredgers, pilot craft, etc. (except gas carriers and chemical tankers) of less than 500 gross tonnage (GT) engaged on international voyages operating in both unrestricted and restricted waters areas.

9.1.2 These vessels should fulfil the applicable requirements of this *Part V* and in each particular case the requirements specified in this chapter 9.

9.1.3 Vessels carrying dangerous goods – chemicals, and/or liquefied gasses in bulk, should comply with IMDG*, IGC and IBC Codes, as applicable. (Ch. I/1)

* Refer to MSC.1/Circ.1266 – *Carriage of dangerous goods (Document of compliance with SOLAS regulation II-2/19).*

9.2 Fire pumps and fire main systems (Ch. IV/1)

9.2.1 Capacity

The total capacity of the main fire pump(s) is not to be less than:

$$Q = (0{,}145\ (L\ (B+D))^{1/2}+2{,}170)^2 \text{ – but need not exceed } 25\,\text{m}^3/\text{hour}$$

where:

B = greatest moulded breadth of vessel, in metres
D = moulded depth to bulkhead deck, in metres
L = Freeboard Length, in metres
Q = total capacity, in m^3/hour (Ch. IV/1.1.1)

9.2.2 Fire pumps

Generally one main power pump and one portable fire pump should be provided as specified below. (Ch. IV/1.1.2)

9.2.2.1 Sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil, and that, if they are subject to occasional duty for the transfer or pumping of fuel oil, suitable changeover arrangements are fitted. (Ch. IV/1.1.2.1)

9.2.2.2 A power pump is a fixed pump driven by a power source other than by hand. (Ch. IV/1.1.2.2)

9.2.2.3 In cargo vessels classed for navigation in ice, the fire pump sea inlet valves should be provided with ice clearing arrangements. (Ch. IV/1.1.2.3)

9.2.2.4 Relief valves should be provided in conjunction with any fire pump if the pump is capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants and hoses. These valves should be so placed and adjusted as to prevent excessive pressure in any part of the fire main system. (Ch. IV/1.1.2.4)

9.2.2.5 Where a centrifugal pump is provided in order to comply with this sub-section, a non-return valve should be fitted in the pipe connecting the pump to the fire main. (Ch. IV/1.1.2.5)

9.2.3 Portable fire pumps (Ch. IV/1.1.3)

9.2.3.1 Portable fire pumps should comply with the following:

(a) The pump should be self-priming.

(b) The total suction head and the net positive suction head of the pump should be determined taking account of actual operation, i.e. pump location when used.

(c) The portable fire pump, when fitted with its length of discharge hose and nozzle, should 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 the greater.

(d) Except for electric pumps, the pump set should have its own fuel tank of sufficient capacity to operate the pump for three hours. For electric pumps, their batteries should have sufficient capacity for three hours.

(e) Except for electric pumps, details of the fuel type and storage location should be carefully considered. If the fuel type has a flashpoint below 60°C, further consideration to the fire safety aspects should be given.

(f) The pump set should be stored in a secure, safe and enclosed space, accessible from open deck and clear of the Category 'A' machinery space.

(g) The pump set should be easily moved and operated by two persons and be readily available for immediate use.

(h) Arrangements should be provided to secure the pump at its anticipated operating position(s).

(i) The overboard suction hose should be non-collapsible and of sufficient length, to ensure suction under all operating conditions. A suitable strainer should be fitted at the inlet end of the hose.

(j) Any diesel-driven power source for the pump should be capable of being readily started in its cold condition by hand (manual) cranking. If this is impracticable, consideration should be given to the provision and maintenance of heating arrangements, so that readily starting can be ensured. (Ch. IV/1.1.3.1)

9.2.3.2 Alternatively to the requirements of 9.2.3.1 (Rec. of 1.1.3.1) a fixed fire pump may be fitted, which should comply with the following:

(a) The pump, its source of power and sea connection should be located in accessible positions, outside the compartment housing the main fire pump.

(b) The sea valve should be capable of being operated from a position near the pump.

(c) The room where the fire pump prime mover is located should be illuminated from the emergency source of electrical power, and should be well ventilated.

(d) Pump is required to supply water for a fixed fire-extinguishing system in the space where the main fire pump is situated, it should be capable of simultaneously supplying water to this system and the fire main at the required rates.

(e) The pump may also be used for other suitable purposes, subject to the approval in each case.

(f) Pressure and quantity of water delivered by the pump being sufficient to produce a jet of water, at any nozzle, of not less than 12 m in length. For vessels of less than 150 GT, the jet of water may be specially considered. (Ch. IV/1.1.3.2)

9.2.3.3 For vessels less than 150 GT fitted with an approved fixed fire-fighting system in the engine room, portable pumps may be omitted. (Ch. IV/1.1.3.3)

9.2.3.4 Means to illuminate the stowage area of the portable pump and its necessary areas of operation should be provided from the emergency source of electrical power. (Ch. IV/1.1.3.4)

9.2.4 Fire main (Ch. IV/1.2)

9.2.4.1 The diameter of the fire main should be based on the required capacity of the fixed main fire pump(s) and the diameter of the water service pipes should be sufficient to ensure an adequate supply of water for the operation of at least one fire hose. (Ch. IV/1.2.1)

9.2.4.2 The wash deck line may be used as a fire main provided that the provisions (Recommendations) of this sub-Section are satisfied. (Ch. IV/1.2.2)

9.2.4.3 All exposed water pipes for fire-extinguishing should be provided with drain valves for use in frosty weather. The valves should be located where they will not be damaged by cargo. (Ch. IV/1.2.3)

9.2.5 Pressure in the fire main (Ch. IV/1.3)

When the main fire pump is delivering the quantity of water required by par. 9.2.1 (Rec. par. 1.1.1), or the fire pump described in 9.2.3.2 (Rec. par. 1.1.3.2), through the fire main, fire hoses and nozzles, the pressure maintained at any hydrant should be sufficient to produce a jet throw at any nozzle of not less than 12 m in length. (For vessels less than 150 GT, the jet of water may be specially considered). (Ch. IV/1.3.1)

9.2.6 Fire hydrants (Ch. IV/1.4)

9.2.6.1 Number and position of hydrants (Ch. IV/1.4.1)

9.2.6.1.1 For vessels less than 150 GT the number and position of the hydrants should be such that at least one jet of water may reach any part normally accessible to the crew, while the cargo vessel is being navigated and any part of any cargo space when empty. Furthermore, such hydrants should be positioned near the accesses to the protected spaces. (At least one hydrant should be provided in each Category 'A' machinery space). (Ch. IV/1.4.1.1)

9.2.6.1.2 For vessels equal or greater than 150 GT the number and position of hydrants should be such that at least two jets of water not emanating from the same hydrant, one of which should be from a single length of hose, may reach any part of the vessel normally accessible to the crew while the vessel is being navigated and any part of any cargo spaces when empty. Furthermore, such hydrants should be positioned near the accesses to the protected spaces. Other Requirements specified by the Administration may be considered. (Ch. IV/1.4.1.2)

9.2.6.2 Pipes and hydrants (Ch. IV/1.4.2)

9.2.6.2.1 Materials readily rendered ineffective by heat should not be used for fire mains. Where steel pipes are used, they should be galvanized internally and externally. Cast iron pipes are not acceptable. The pipes and hydrants should be so placed that the fire-hoses may be easily coupled to them. The arrangement of pipes and hydrants should be such as to avoid the possibility of freezing. In vessels where deck cargo may be carried, the positions of the hydrants should be such that they are always readily accessible and the pipes should be arranged, as far as practicable, to avoid risk of damage by such cargo. There should be complete interchangeability of hose couplings and nozzles. (Ch. IV/1.4.2.1)

9.2.6.2.2 A valve should be fitted at each fire hydrant so that any fire-hose may be removed while the fire pump is at work. (Ch. IV/1.4.2.2)

9.2.6.2.3 Where a fixed fire pump is fitted outside the engine room, in accordance with 9.2.3.2 (Rec. par. 1.1.3.2):

(a) an isolating valve should be fitted in the fire main so that all the hydrants in the vessel, except that or those in the Category 'A' machinery space, can be supplied with water. The isolating valve should be located in an easily accessible and tenable position outside the Category 'A' machinery space; and

(b) the fire main should not re-enter the machinery space downstream of the isolating valve. (Ch. IV/1.4.2.3)

9.2.7 Fire-hoses (Ch. IV/1.5)

9.2.7.1 Fire-hoses should be of approved non-perishable material. The hoses should be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Their length, in general, is not to exceed 18 m. Each hose should be provided with a nozzle and the necessary couplings. Fire-hoses, together with any necessary fittings and tools, should be kept ready for use in conspicuous positions near the water service hydrants or connections. (Ch. IV/1.5.1)

9.2.7.2 For vessel less than 150 GT, one hose should be provided for each hydrant. In addition one spare hose should be provided onboard. (Ch. IV/1.5.2)

9.2.7.3 Vessel equal or greater than 150 GT should be provided with fire hoses the number of which should be one for each 30 m length of the ship and one spare, but in no case less than three in all. Unless one hose and nozzle is provided for each hydrant in the ship, there should be complete interchangeability of hose couplings and nozzles. (Ch. IV/1.5.3)

9.2.8 Nozzles (Ch. IV/1.6)

9.2.8.1 For the purpose of this Chapter 9, standard nozzle sizes are 12 mm, 16 mm or 19 mm, or as near thereto as possible, so as to make full use of the maximum discharge capacity of the fire pump(s). (Ch. IV/1.6.1)

9.2.8.2 For accommodation and service spaces, the nozzle size need not exceed 12 mm. (Ch. IV/1.6.2)

9.2.8.3 The size of nozzles used in conjunction with a portable fire pump need not exceed 12 mm. (Ch. IV/1.6.3)

9.2.8.4 All nozzles should be of an approved dual purpose type (i.e. spray/jet type) incorporating a shut-off. (Ch. IV/1.6.4)

9.3 Structural fire protection

The minimum fire integrity of bulkheads and decks should be as prescribed in Table 9.3.

Table 9.3
Minimum fire integrity of bulkheads and decks

Item	Space	Separation by	From Space
(1)	Machinery Space Class ‘A’	A-60	Accommodation/ control stations /corridors/ staircases/ service spaces of high fire risk/ ro-ro spaces/ vehicle space
(2)	Machinery Space Class ‘A’	A-0	Other than above [item (1)]

Item	Space	Separation by	From Space
(3)	Galley	A-0	Unless specified otherwise
(4)	Service space of high fire risk other than galley	B-15	Unless specified above [item (1)]
(5)	Corridor Staircase	B-0	Unless specified above [item (1)]
(6)	Cargo Space (other than ro-ro spaces and vehicle space)	A-0	Unless specified above [item (1)]
(7)	Ro-ro space and vehicle space (except weather deck)	A-60	Control stations/machinery spaces of category 'A'
(8)	Ro-ro space and vehicle space (except weather deck)	A-0	Unless specified above [item (1)]

Category 'A' machinery spaces should be enclosed by "A-60" Class divisions, where adjacent to:

1. Accommodation spaces
2. Control stations
3. Corridors and staircases
4. Service spaces of high fire risk,

and by "A-0" Class divisions elsewhere.

The divisions used to separate spaces, not mentioned above, should be of non-combustible material. (Ch. IV/2.1.1)

9.3.1 The hull, superstructure, structural bulkheads, decks and deckhouses should be constructed of steel or other equivalent material. For the purpose of applying the definition of steel or other equivalent material, as given in sub-chapter 1.2 (SOLAS), the 'applicable fire exposure' should be one hour. Vessels built of materials other than steel should be specially considered. (Ch. IV/2.1.1.1)

9.3.2 Stairways should be enclosed, at least at one level, by divisions and doors or hatches, in order to restrict the free flow of smoke to other decks in the vessel and the supply of air to the fire. Doors forming such enclosures should be self-closing. (Ch. IV/2.1.1.2)

9.3.3 Openings in 'A' Class divisions should be provided with permanently attached means of closing which should be at least as effective for resisting fires as the divisions in which they are fitted. (Ch. IV/2.1.1.3)

9.3.4 Interior stairways serving machinery spaces, accommodation spaces, service spaces or control stations should be of steel or other equivalent material. (Ch. IV/2.1.1.4)

9.3.5 Doors should be self-closing in way of Category 'A' machinery spaces and galleys, except where they are normally kept closed. (Ch. IV/2.1.1.5)

9.3.6 Where 'A' Class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc., or for girders, beams or other structural members, arrangements should be made to ensure that the fire resistance is not impaired. Arrangements should also prevent the transmission of heat to un-insulated boundaries at the intersections and terminal points of the divisions and penetrations by insulating the horizontal and vertical boundaries or penetrations for a distance of 450 mm. (Ch. IV/2.1.1.6)

9.4 Materials (Ch. IV/2.1.2)

9.4.1 Paints, varnishes and other finishes used on exposed interior surfaces should not be capable of producing excessive quantities of smoke, toxic gases or vapours and should be of the low flame spread type in accordance with the IMO FTP Code, Annex 1, Parts 2 and 5. (Ch. IV/2.1.2.1)

9.4.2 Except in cargo spaces or refrigerated compartments of service spaces, insulating materials should be non-combustible. (Ch. IV/2.1.2.2)

9.4.3 Where pipes penetrate 'A' or 'B' Class divisions, the pipes or their penetration pieces should be of steel or other approved materials having regard to the temperature and integrity Recommendations such divisions are required to withstand. (Ch. IV/2.1.2.3)

9.4.4 Pipes conveying oil or combustible liquids through accommodation and service spaces should be of steel or other approved materials having regard to the fire risk. (Ch. IV/2.1.2.4)

9.4.5 Materials readily rendered ineffective by heat should not be used for overboard scuppers, sanitary discharges and other outlets which are close to the waterline, and where the failure of the material in the event of fire would give rise to the danger of flooding. (Ch. IV/2.1.2.5)

9.4.6 Primary deck coverings within accommodation spaces, service spaces and control stations should be of a type which will not readily ignite, or give rise to toxic or explosive hazards at elevated temperatures in accordance with the IMO FTP Code, Annex 1, Parts 2 and 6. (Ch. IV/2.1.2.6)

9.4.7 Materials used for insulating pipes, etc., in machinery spaces and other compartments containing high fire risks should be non-combustible. Vapour barriers and adhesives used in conjunction with insulation, as well as the insulation of pipe fittings, for cold service systems need not be of non-combustible materials, but they should be kept to the minimum quantity practicable and their exposed surfaces should have low flame spread characteristics. (Ch. IV/2.1.2.7)

9.5 Surface of insulation (Ch. IV/2.1.3)

In spaces where penetration of oil products is possible, the surface of the insulation should be impervious to oil or oil vapours. Insulation boundaries should be arranged to avoid immersion in oil spillage. (Ch. IV/2.1.3.1)

9.6 Ventilation systems (Ch. IV/2.1.4)

9.6.1 Ventilation fans should be capable of being stopped and main inlets and outlets of ventilation systems closed from outside the spaces being served. (Ch. IV/2.1.4.1)

9.6.2 Ventilation ducts for Category 'A' machinery spaces, ro-ro spaces and vehicle spaces should not pass through accommodation spaces, galleys, service spaces or control stations, unless the ducts are constructed of steel and arranged to preserve the integrity of the division. (Ch. IV/2.1.4.2)

9.6.3 Ventilation ducts for accommodation spaces, service spaces or control stations should not pass through Category 'A' machinery spaces or galleys unless the ducts are constructed of steel and arranged to preserve the integrity of the division. (Ch. IV/2.1.4.3)

9.6.4 Ventilation arrangement for store rooms containing highly flammable products should be specially considered. (Ch. IV/2.1.4.4)

9.6.5 Ventilation systems serving Category 'A' machinery spaces and galley exhaust ducts should be independent of systems serving other spaces. (Ch. IV/2.1.4.5)

9.6.6 Ventilation should be provided to prevent the accumulation of gases that may be emitted from batteries. (Ch. IV/2.1.4.6)

9.6.7 Ventilation openings may be fitted in and under the lower parts of cabin, mess and dayroom doors in corridor bulkheads. The total net area of any such openings is not to exceed 0,05 m^2. Balancing ducts should not be permitted in fire divisions. (Ch. IV/2.1.4.7)

9.7 Oil fuel arrangements (Ch. IV/2.1.5)

9.7.1 In a cargo vessel in which oil fuel is used, the arrangements for the storage, distribution and utilization of the oil fuel should be such as to ensure the safety of the vessel and persons on board. (Ch. IV/2.1.5.1)

9.7.2 Oil fuel tanks situated within the boundaries of Category 'A' machinery spaces should not contain oil fuel having a flashpoint of less than 60°C. (Ch. IV/2.1.5.2)

9.7.3 Oil fuel, lubricating oil and other flammable oils should not be carried in fore peak tanks. (Ch. IV/2.1.5.3)

9.7.4 For vessels of 150 GT or more, and as far as practicable:

(a) Oil fuel lines shall be arranged far apart from hot surfaces, electrical installations or other sources of ignition and shall be screened or otherwise suitably protected to avoid oil spray or oil leakage onto the sources of ignition. The number of joints in such piping systems shall be kept to a minimum.

(b) Surfaces with temperatures above 220°C which may be impinged as a result of a fuel system failure shall be properly insulated. Precautions shall be taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces.

(c) External high-pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors shall be protected with a jacketed piping system capable of containing fuel from a high-pressure line failure. A suitable enclosure on engines having an output of 375 kW or less having fuel injection pumps serving more than one injector may be used as an alternative to the jacketed piping system. (Ch. IV/2.1.5.4)

9.8 Special arrangements in Category 'A' machinery spaces and where necessary other machinery spaces (Ch. IV/2.1.6)

9.8.1 The number of skylights, doors, ventilators, openings in funnels to permit exhaust ventilation and other openings to machinery spaces should be reduced to a minimum consistent with the needs of ventilation and the proper and safe working of the cargo vessel. (Ch. IV/2.1.6.1)

9.8.2 Skylights should be of steel and are not to contain glass panels. Suitable arrangements should be made to permit the release of smoke, in the event of fire, from the space to be protected. (Ch. IV/2.1.6.2)

9.8.3 Windows should not be fitted in machinery space boundaries. This does not preclude the use of glass in control rooms within the machinery spaces. (Ch. IV/2.1.6.3)

9.8.4 Means of control should be provided for:

(a) opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation, and closure of ventilator dampers;
(b) permitting the release of smoke;
(c) closing power-operated doors or actuating release mechanism on doors other than power-operated watertight doors;
(d) stopping ventilating fans; and
(e) stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps and other similar fuel pumps. (Ch. IV/2.1.6.4)

9.8.5 The controls required in 9.8.4 (2.1.6.4) should be located outside the space concerned, where they will not be cut off in the event of fire in the space they serve. Such controls and the controls for any required fire-extinguishing system should be situated at one control position or grouped in as few positions as possible. Such positions should have a safe access from the open deck. (Ch. IV/2.1.6.5)

9.9 Arrangements for gaseous fuel for domestic purposes (Ch. IV/2.1.7)

Where gaseous fuel is used for domestic purposes, the arrangements for the storage, distribution and utilization of the fuel should be specially considered. (Ch. IV/2.1.7.1)

9.10 Space heating (Ch. IV/2.1.8)

Space heaters, if used, should be fixed in position and so constructed as to reduce fire risks to a minimum. The design and location of these units should be such that clothing, curtains or other similar materials cannot be scorched or set on fire by heat from the unit. (Ch. IV/2.1.8.1)

9.11 Means of escape (Ch. IV/2.2)

9.11.1 Stairways, ladders and corridors serving crew spaces and other spaces to which the crew normally have access should be arranged so as to provide ready means of escape to a deck from which embarkation into survival craft may be effected. (Ch. IV/2.2.1)

9.11.2 There should be at least two means of escape, as widely separated as possible, from each section of accommodation and service spaces and control stations.

(a) The normal means of access to the accommodation and service spaces below the open deck should be arranged so 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).
(b) The second means of escape may be through portholes or hatches of adequate size and preferably leading directly to the open deck.
(c) Dead-end corridors having a length of more than 7m should not be accepted. (Ch. IV/2.2.2)

9.11.3 At least two means of escape should be provided from machinery spaces, except where the small size of a machinery space makes it impracticable. Escape should be by steel ladders that should be as widely separated as possible. (Ch. IV/2.2.3)

9.12 Fixed fire detection and fire-alarm systems

An approved and fixed fire detection system, complying with applicable requirements of sub-chapter 4.1 should be installed in all Category 'A' machinery spaces and cargo pump rooms. (Ch. IV/3)

9.13 Fixed fire-extinguishing arrangements in Category 'A' machinery spaces (Ch. IV/4.1)

Machinery spaces of category 'A' on vessels with GT greater than or equal to 150 and operating in unrestricted or restricted waters, should be provided with an approved fixed fire extinguishing system, as specified in par. 9.14 (4.2). Machinery spaces of category 'A' on vessels operating in protected areas may be exempted from this recommendation. (Ch. IV/4.1.1)

9.14 Fixed Fire-extinguishing systems (Ch. IV/4.2)

Fixed fire-fighting systems where required, should be in accordance with the requirements of the chapter 3 (IMO FSS Code). (Ch. IV/4.2.1)

9.15 Protection of paint lockers and flammable liquid lockers (Ch. IV/4.3)

The requirements for the protection of paint lockers and flammable liquids lockers should be specially considered. (Ch. IV/4.3.1)

9.16 Fixed fire-extinguishing systems not required by this chapter (Ch. IV/4.4)

If such a system is installed, it should be of an approved type. (Ch. IV/4.4.1)

9.17 Portable fire-extinguishers

9.17.1 The number of fire-extinguishers should be as below.

Accommodation and service spaces.

- Vessels greater than or equal to 150 GT – ≥ 3
- Vessels less than 150 GT (see 4.5.6.1) – ≥ 1

Machinery spaces (one extinguisher per
every 375 kW of internal combustion engine power) – ≥ 2 but ≤ 6 (Ch. IV/4.5)

9.17.2 All fire-extinguishers should be of approved types and designs. (Ch. IV/4.5.1.1)

9.17.3 The extinguishing media employed should be suitable for extinguishing fires in the compartments in which they are intended to be used. (Ch. IV/4.5.2.1)

9.17.4 The extinguishers required for use in the machinery spaces of cargo vessels using oil as fuel should be of a type discharging foam, carbon dioxide gas, dry powder or other approved media suitable for extinguishing oil fires. (Ch. IV/4.5.2.2)

9.17.5 The capacity of required portable fluid extinguishers should not exceed more than 13,5 litres but not less than 9 litres. Other extinguishers should be at least as portable as the 13,5 litre fluid extinguishers, and should have a fire-extinguishing capability at least equivalent to a 9 litre fluid extinguisher. (Ch. IV/4.5.3.1)

9.17.6 The following capacities may be taken as equivalents:

- 9 litre fluid extinguisher (water or foam)
- 5 kg dry powder
- 5 kg carbon dioxide (Ch. IV/4.5.3.2)

9.17.7 A spare charge should be provided for each required portable fire-extinguisher that can be readily recharged on board. If this cannot be done, duplicate extinguishers should be provided. (Ch. IV/4.5.4.1)

9.17.8 The extinguishers should be stowed in readily accessible positions and should be spread as widely as possible and not be grouped. (Ch. IV/4.5.5.1)

9.17.9 One of the portable fire-extinguishers intended for use in any space should be stowed near the entrance to that space. (Ch. IV/4.5.5.2)

9.17.10 Accommodation spaces, service spaces and control stations should be provided with a sufficient number of portable fire-extinguishers to ensure that at least one extinguisher will be readily available for use in every compartment of the crew spaces. In any case, their number should be not less than three, except where this is impractical for very small vessels, in which case one extinguisher should be available at each deck having accommodation or service spaces, or control stations. (Ch. IV/4.5.6.1)

9.18 Fire- fighting equipment (Ch. IV/5)

9.18.1 A fire blanket should be provided. (Ch. IV/5.1.1)

9.18.2 All cargo vessels greater than or equal to 150 GT should carry at least one firefighter's outfit complying with the Requirements of sub-chapter 5.4 (IMO FSS Code). (Ch. IV/5.2.1)

9.19 Fire control plans (Ch. IV/5.3)

9.19.1 In all cargo vessels, general arrangement plans should be permanently exhibited for the guidance of the vessel's officers, using graphical symbols that are in accordance with IMO Res. A.952(23) and in Res. A.1116(30), which show clearly for each deck the control stations, the various fire sections enclosed by steel or 'A' Class divisions, together with particulars of:
- the fire detection and fire-alarm systems;
- fixed fire-fighting system;
- the fire-extinguishing appliances;
- the means of access to different compartments, decks, etc.;
- the position of the fireman's outfits;
- the ventilating system, including particulars of the fan control positions, the position of dampers and identification numbers of the ventilating fans serving each section; and
- the location and arrangement of the emergency stop for the oil fuel unit pumps and for closing the valves on the pipes from oil fuel tanks. (Ch. IV/5.3.1.1)

9.19.2 Alternatively, the details required by par. 9.19.1 (5.3.1.1) may be set out in a booklet, a copy of which should be supplied to each officer, and one copy is at all times to be available on board in an accessible position. (Ch. IV/5.3.1.2)

9.19.3 Description in such plans and booklets should be in the official language of the Flag State and in the English language – for vessels of unrestricted service. In addition, instructions concerning the maintenance and operation of all the equipment and installations on board for the fighting and containment of fire should be kept under one cover, readily available in an accessible position. (Ch. IV/5.3.1.3)

9.19.4 In all cargo vessels greater than or equal to 150 GT, a duplicate set of fire-control plans or a booklet containing such plans should be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shoreside firefighting personnel. (Ch. IV/5.3.1.4)

9.20 Additional fire safety measures for tankers (Ch. IV/6)

9.20.1 General (Ch. IV/6.1)

The requirements for tankers of this *Part V* (SOLAS Chapter II-2) should apply to tankers carrying crude oil and petroleum products, having a flash point not exceeding 60°C, and other liquid products having a similar fire hazard. (Ch. IV/6.1.1)

9.20.2 Application (Ch. IV/6.2)

9.20.2.1 The additional requirements for tankers of this *Part V* (SOLAS Chapter II-2) should apply to tankers carrying crude oil and 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, and other liquid products having a similar fire hazard. (Ch. IV/6.2.1)

9.20.2.2 Tankers carrying petroleum products having a flashpoint exceeding 60°C (closed cup test), as determined by an approved flashpoint apparatus, should comply with the provisions of 9.20.3 (6.3). (Ch. IV/6.2.2)

9.20.3 Cargo area deck protection (Ch. IV/6.3)

9.20.3.1 At least one mobile foam appliance should be provided for use on the cargo tank deck including the cargo manifolds. It should be capable of simple and rapid operation. Where the appliance is of the inductor type it should comply with 9.20.3.2 (6.3.2). Self-contained appliances should have a foam solution capacity of at least 135 litres. (Ch. IV/6.3.1)

9.20.3.2 A portable foam applicator unit should consist of an air foam nozzle of an inductor type capable of being connected to the fire main by a fire hose, together with a portable tank containing at least 20 litres of foam-making liquid and one spare tank. The nozzle should be capable of producing effective foam, suitable for extinguishing an oil fire, at the rate of at least 1,5 m^3/min. (Ch. IV/6.3.2)

9.20.3.3 The type of foam used should be suitable for the cargoes to be carried. (Ch. IV/6.3.3)

9.21 Alternative design and arrangements (Ch. IV/7)

9.21.1 Fire safety design and arrangements may deviate from Sections of this chapter 9, provided that the design and arrangements meet the fire safety objectives and the functional Recommendations. (Ch. IV/7.2.1)

9.21.2 Methodology for alternative design and arrangements for fire safety should be performed in accordance with chapter 10, based on fire safety objectives, as below. (Ch. IV/7.2.2)

The fire safety objectives of this chapter 9 are to:
- prevent the occurrence of fire and explosion;
- reduce the risk to life caused by fire;
- reduce the risk of damage caused by fire to the vessel, its cargo and the environment;
- contain, control and suppress fire and explosion in the compartment of origin; and
- provide adequate and readily accessible means of escape for crew. (Ch. IV)

9.22 Fire extinguishing requirements for vessels not fitted with propelling machinery (Ch. IV/8)

Arrangements for fire protection, detection and extinction in vessels not fitted with propelling machinery should be specially considered in each case and should depend on the size and purpose of the vessel and the presence of accommodation spaces, machinery and combustible materials on board. (Ch. IV/8.1.1)

END OF IACS REC. 99 (EXCERPTS)

9.23 Fire-protection equipment for ships engage in domestic voyages

List of required fire protection equipment for various types of ships of less than 500 gross tonnage engage in domestic voyages are given in Table 9.23.

Table 9.23
Fire protection equipment for ships of less than 500 gross tonnage[1)]

Item	Type of ship	9 *l* foam fire extinguisher or equivalent	Carbon dioxide fire extinguisher	45 *l* mobile foam fire extinguisher	Fire hose, dual-purpose nozzle	Fire blanket	Fire-fighter's outfit	Fire-fighter's axe and crowbar	Fire gloves
1	Cargo ship	5	5	–	Number equal to the number of hydrants installed on shipboard	2	1[2)]	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[2)]	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

1) Unless expressly provided otherwise by the flag State Administration.
2) Applies to ships of gross tonnage 150 and upwards.

CHAPTER 10

10 ALTERNATIVE DESIGN AND ARRANGEMENTS

10.1 General

10.1.1 Fire safety design and arrangements may deviate from the prescriptive requirements set out in this *Part V* (SOLAS parts B, C, D, E or G), provided that the design and arrangements meet the fire safety objectives and the functional requirements. (SOLAS II-2/17.2.1)

10.1.2 When fire safety design or arrangements deviate from the prescriptive requirements of this *Part V* (chapter), engineering analysis, evaluation and approval of the alternative design and arrangements shall be carried out in accordance with this chapter 10 (regulation). (SOLAS II-2/17.2.2)

10.2 Fire safety objectives

10.2.1 The fire safety objectives of this *Part V* (chapter) are to:

.1 prevent the occurrence of fire and explosion;
.2 reduce the risk to life caused by fire;
.3 reduce the risk of damage caused by fire to the ship, its cargo and the environment;
.4 contain, control and suppress fire and explosion in the compartment of origin; and
.5 provide adequate and readily accessible means of escape for passengers and crew. (SOLAS II-2/2.1)

10.3 Functional requirements

10.3.1 In order to achieve the fire safety objectives set out in sec.10.2 (SOLAS par. 2.1) above, the following functional requirements are embodied in the regulations of this *Part V* (chapter) as appropriate:

.1 division of the ship into main vertical and horizontal zones by thermal and structural boundaries;
.2 separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;
.3 restricted use of combustible materials;
.4 detection of any fire in the zone of origin;
.5 containment and extinction of any fire in the space of origin;
.6 protection of means of escape and access for fire-fighting;
.7 ready availability of fire-extinguishing appliances; and
.8 minimization of possibility of ignition of flammable cargo vapour. (SOLAS II-2/2.2)

10.4 Achievement of the fire safety objectives

The fire safety objectives set out in sec.10.2 (SOLAS par. 2.1) above shall be achieved by ensuring compliance with the prescriptive requirements specified in this *Part V* (SOLAS parts B, C, D, E or G), or by alternative design and arrangements which comply with sec. 10.5 to 10.8 (SOLAS Part F). A ship shall be considered to meet the functional requirements set out in sec. 10.3 and to achieve the fire safety objectives set out in sec. 10.2 when either:

.1 the ship' s designs and arrangements, as a whole, complies with the relevant prescriptive requirements in this *Part V* (SOLAS parts B, C, D, E or G);
.2 the ship' s designs and arrangements, as a whole, have been reviewed and approved in accordance with sec. 10.5 to 10.8 as alternative design and arrangements (SOLAS part F); or

.3 part(s) of the ship' s designs and arrangements have been reviewed and approved in accordance with sec. 10.5 to 10.8 as alternative design and arrangements (SOLAS part F) and the remaining parts of the ship comply with the relevant prescriptive requirements in this *Part V* (SOLAS parts B, C, D, E or G). (SOLAS II-2/2.3)

10.5 Engineering analysis

The engineering analysis shall be prepared and submitted to the Administration, based on the guidelines developed by the Organization* and shall include, as a minimum, the following elements:

* Refer to *Guidelines on alternative design and arrangements for fire safety* (MSC/Circ.1002 and its Corr.1, Corr.2 and Corr.3, as amended by MSC.1/Circ.1552).

.1 determination of the ship type and space(s) concerned;
.2 identification of prescriptive requirement(s) with which the ship or the space(s) will not comply;
.3 identification of the fire and explosion hazards of the ship or the space(s) concerned;
  .3.1 identification of the possible ignition sources;
  .3.2 identification of the fire growth potential of each space concerned;
  .3.3 identification of the smoke and toxic effluent generation potential for each space concerned;
  .3.4 identification of the potential for the spread of fire, smoke or of toxic effluents from the space(s) concerned to other spaces;
.4 determination of the required fire safety performance criteria for the ships or the space(s) concerned addressed by the prescriptive requirement(s);
  .4.1 performance criteria shall be based on the fire safety objectives and on the functional requirements of this *Part V* (chapter);
  .4.2 performance criteria shall provide a degree of safety not less than that achieved by using the prescriptive requirements; and
  .4.3 performance criteria shall be quantifiable and measurable;
.5 detailed description of the alternative design and arrangements, including a list of the assumptions used in the design and any proposed operational restrictions or conditions; and
.6 technical justification demonstrating that the alternative design and arrangements meet the required fire safety performance criteria. (SOLAS II-2/17.3)

10.6 Evaluation of the alternative design and arrangements

10.6.1 The engineering analysis required in sec. 10.5 (SOLAS par. 3) shall be evaluated and approved by the Administration taking into account the guidelines developed by the Organization.* (SOLAS II-2/17.4.1)

* Refer to *Guidelines on alternative design and arrangements for fire safety* (MSC/Circ.1002 and its Corr.1, Corr.2 and Corr.3, as amended by MSC.1/Circ.1552).

10.6.2 A copy of the documentation, as approved by the Administration, indicating that the alternative design and arrangements comply with this chapter 10 (regulation) shall be carried onboard the ship. (SOLAS II-2/17.4.2)

10.7 Exchange of information

The Administration shall communicate to the Organization pertinent information concerning alternative design and arrangements approved by them for circulation to all contracting governments. (SOLAS II-2/17.5)

10.8 Re-evaluation due to change of conditions

If the assumptions, and operational restrictions that were stipulated in the alternative design and arrangements are changed, the engineering analysis shall be carried out under the changed condition and shall be approved by the Administration*. (SOLAS II-2/17.6)

* See MSC.1/Circ.1455: *Guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments.*

CHAPTER 11

11 ADDITIONAL REQUIREMENTS FOR SPECIFIC SHIP TYPES

11.1 Passenger ships – additional marks: PASSENGER SHIP, PASSENGER SHIP (FERRY), PASSENGER SHIP (FERRY W), RO-RO/PASSENGER SHIP, RO-RO/PASSENGER SHIP (FERRY)

11.1.1 Ship construction

11.1.1.1 General requirements

The construction of ceiling and bulkheads shall be such that it will be possible, without impairing the efficiency of the fire protection, for the fire patrols to detect any smoke originating in concealed and inaccessible places, except where in the opinion of the Administration there is no risk of fire originating in such places. Inspection hatches are accepted for this purpose. (SOLAS II-2/7.8.2)

11.1.1.2 Fire protection materials

11.1.1.2.1 Use of non-combustible materials

11.1.1.2.1.1 Ceilings and linings

In passenger ships, except in cargo spaces, all linings, grounds, draught stops and ceilings shall be of non-combustible material except in mail rooms, baggage rooms, saunas or refrigerated compartments of service spaces. (SOLAS II-2/5.3.1.2.1)

11.1.1.2.1.2 Partial bulkheads and decks on passenger ships

11.1.1.2.1.2.1 Partial bulkheads or decks used to subdivide a space for utility or artistic treatment shall be of non-combustible materials. (SOLAS II-2/5.3.1.3.1)

11.1.1.2.1.2.2 Linings, ceilings and partial bulkheads or decks used to screen or to separate adjacent cabin balconies shall be of non-combustible materials. (SOLAS II-2/5.3.1.3.2)

11.1.1.2.2 The use of combustible materials

11.1.1.2.2.1 General

In passenger ships, "A", "B" or "C" class divisions in accommodation and services spaces and cabin balconies which are faced with combustible materials, facings, mouldings, decorations and veneers shall comply with the provisions of par. 2.1.3.2.2 to 2.1.3.2.4 and 2.1.3.2.5 to 2.1.3.2.6 (SOLAS II-2/5.3.2.2 to 3.2.4 and reg. 6). However, traditional wooden benches and wooden linings on bulkheads and ceilings are permitted in saunas and such materials need not be subject to the calculations prescribed in par. 2.1.3.2.2 and 2.1.3.2.3 (SOLAS II-2/5.3.2.2 and 3.2.3). However, the provisions of par. 2.1.3.2.3 (SOLAS II-2/5.3.2.3) need not be applied to cabin balconies. (SOLAS II-2/5.3.2.1.1)

11.1.1.2.2.2 Low flame-spread characteristics of exposed surfaces

The following surfaces* shall have low flame-spread characteristics in accordance with the *FTP Code*:

- **.1** exposed surfaces in corridors and stairway enclosures and of bulkhead and ceiling linings in accommodation and service spaces (except saunas) and control stations; and
- **.2** surfaces and grounds in concealed or inaccessible spaces in accommodation and service spaces and control stations.

.3 exposed surfaces of cabin balconies, except for natural hard wood decking systems. (SOLAS II-2/5.3.2.4.1)

**** IMO interpretation***

The requirements relate to the surfaces of bulkheads, decks, floor coverings, wall claddings and ceilings, as appropriate. The requirements do not apply to plastic pipes, electric cables and furniture. *(MSC/Circ.1120)*

Note:
For examples of material application and surface coatings, see IACS UI SC126.

11.1.1.3 Paints, varnishes and other finishes

On passenger ships, paints, varnishes and other finishes used on exposed surfaces of cabin balconies, excluding natural hard wood decking systems, shall not be capable of producing excessive quantities of smoke and toxic products, this being determined in accordance with the *FTP Code*. (SOLAS II-2/6.2.2)

11.1.1.4 Primary deck coverings

11.1.1.4.1 Primary deck coverings*, if applied within accommodation and service spaces and control stations, or if applied on cabin balconies, shall be of approved material which will not readily ignite, this being determined in accordance with *FTP Code*. (SOLAS II-2/4.4.4)

Note:
* For examples of the use of materials and finishes in accommodation spaces on cargo and passenger ships – see IACS UI SC126.

11.1.1.4.2 On passenger ships, primary deck coverings on cabin balconies shall not give rise to smoke, toxic or explosive hazards at elevated temperatures, this being determined in accordance with the *FTP Code*. (SOLAS II-2/6.3.2)

11.1.1.5 Furniture in stairway enclosures of passenger ships

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 determined in accordance with the *FTP Code*, and shall not restrict the passenger escape route. The Administration may permit 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. Furniture shall not be permitted in passenger and crew corridors forming escape routes in cabin areas. In addition to the above, lockers of non-combustible material, providing storage for non- hazardous safety equipment required by these regulations, 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 applies as well to decorative flower or plant arrangements, statues or other objects of art such as paintings and tapestries in corridors and stairways. (SOLAS II-2/5.3.3)

11.1.1.6 Furniture and furnishings on cabin balconies of passenger ships

On passenger ships, furniture and furnishings on cabin balconies shall comply with par. 1.2.40.1, 1.2.40.2, 1.2.40.3, 1.2.40.6 and 1.2.40.7 (SOLAS reg. 3.40.1, 3.40.2, 3.40.3, 3.40.6 and 3.40.7) unless such balconies are protected by a fixed pressure water-spraying and fixed fire detection and fire alarm systems complying with par. 4.10.1 and 4.10.4 (SOLAS reg. 7.10 and 10.6.1.3). (SOLAS II-2/5.3.4)

11.1.1.7 Means of control in machinery spaces

In passenger ships, the means of controls shall be provided for:
- opening and closure of skylights;
- closure of openings in funnels which normally allow exhaust ventilation;

- closure of ventilator dampers;
- stopping ventilating fans;
- means of control for stopping forced and induced draught fans;
- oil fuel transfer pumps;
- oil fuel unit pumps;
- lubricating oil service pumps;
- thermal oil circulating pumps;
- oil separators (purifiers);
- measures permitting the release of smoke from machinery spaces;
- closing power-operated doors or actuating release mechanisms on doors other than power-operated watertight doors, (SOLAS II-2/5.2.2.1 to 2.2.4 and in reg. 8.3.3 and 9.5.2.3)

In passenger ships, the controls required in par. 11.1.1.7 (SOLAS par. 2.2.1 to 2.2.4 and in reg. 8.3.3 and 9.5.2.3) and the controls for any required fire-extinguishing system shall be situated at one control position or grouped in as few positions as possible to the satisfaction of the Administration. Such positions shall have a safe access from the open deck. (SOLAS II-2/5.2.5)

The location of the control devices for machinery spaces should be marked with the symbol used in the *Fire Control Plan*.

11.1.2 Thermal and structural boundaries

11.1.2.1 Main vertical zones and horizontal zones*

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* ***IACS interpretation***

If a stairway serves two main vertical zones, the maximum length of one main vertical zone should be measured from the far side of the main vertical zone stairway enclosure. In this case, all boundaries of the stairway enclosure be insulated as main vertical zone bulkheads and access doors leading into the stairway should be provided from the zones. (see figures 1 to 4, for SOLAS regulation 9.2.2.1, in the appendix of MSC/Circ.1120). However, the stairway should not be included in calculating the size of the main vertical zone if it is treated as its own main vertical zone.

The number of MVZ of 48m length is not limited as long as they comply with all the requirements. (IACS UI SC101)

11.1.2.1.1.1 In ships carrying more than 36 passengers, the hull, superstructure and deckhouses shall be subdivided into main vertical zones by "A-60" class divisions. Steps and recesses shall be kept to a minimum, but where they are necessary they shall also be "A-60" class divisions. Where a category (5), (9) or (10) space defined in par. 11.1.2.3.2.2 (SOLAS par. 2.2.3.2.2) is on one side or where fuel oil tanks are on both sides of the division the standard may be reduced to "A-0". (SOLAS II-2/9.2.2.1.1.1)

11.1.2.1.1.2 In ships carrying not more than 36 passengers, the hull, superstructure and deckhouses in way of accommodation and service spaces shall be subdivided into main vertical zones by "A" class divisions. These divisions shall have insulation values in accordance with tables in sec. 11.1.2.4 (SOLAS par. 2.2.4). (SOLAS II-2/9.2.2.1.1.2)

11.1.2.1.2 As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the bulkhead deck shall be in line with watertight subdivision bulkheads situated immediately below the bulkhead deck. The length and width of the main vertical zones should generally not exceed 40 m. The length and width of main vertical zones may be extended to a maximum of 48 m in order to bring the ends of main vertical zones to coincide with watertight subdivision bulkheads or in order to accommodate a large public space extending for the whole length of the main vertical zone provided that the total area of the main vertical zone is not greater than 1,600 m^2 on any deck. The length or width of a main vertical zone is the maximum distance between the furthermost points of the bulkheads bounding it. (SOLAS II-2/9.2.2.1.2)

11.1.2.1.3 Such bulkheads shall extend from deck to deck and to the shell or other boundaries. (SOLAS II-2/9.2.2.1.3)

11.1.2.1.4 In ships carrying not more than 36 passengers, where a main vertical zone is subdivided by horizontal "A" class divisions into horizontal zones for the purpose of providing an appropriate barrier between a zone with sprinklers and a zone without sprinklers, the divisions shall extend between adjacent main vertical zone bulkheads and to the shell or exterior boundaries of the ship and shall be insulated in accordance with the fire insulation and integrity values given in table 9.4. (SOLAS II-2/9.2.2.1.4)

11.1.2.1.4.1 On ships designed for special purposes, such as automobile or railroad car ferries, where the provision of main vertical zone bulkheads would defeat the purpose for which the ship is intended, equivalent means for controlling and limiting a fire shall be substituted and specifically approved by the Administration. Service spaces and ship stores shall not be located on ro-ro decks unless protected in accordance with the applicable regulations. (SOLAS II-2/9.2.2.1.5.1)

11.1.2.1.4.2 However, in a ship with special category spaces, such spaces shall comply with the applicable provisions of sec. 11.1.20 (SOLAS reg. 20) and where such compliance would be inconsistent with other requirements for passenger ships specified in this *Part V* (chapter), the requirements of sec. 11.1.20 (SOLAS reg. 20) shall prevail. (SOLAS II-2/9.2.2.1.5.2)

11.1.2.2 Bulkheads within a main vertical zone

11.1.2.2.1 For ships carrying more than 36 passengers, bulkheads which are not required to be "A" class divisions shall be at least "B" class or "C" class divisions as prescribed in the tables in sec. 11.1.2.3. (SOLAS par. 2.2.3). (SOLAS II-2/9.2.2.2.1)

11.1.2.2.2 For ships carrying not more than 36 passengers, bulkheads within accommodation and service spaces which are not required to be "A" class divisions shall be at least "B" class or "C" class divisions as prescribed in the tables in sec. 11.1.2.4 (SOLAS par. 2.2.4). In addition, corridor bulkheads, where not required to be "A" class, shall be "B" class divisions which shall extend from deck to deck except:

.1 when continuous "B" class ceilings or linings are fitted on both sides of the bulkhead, the portion of the bulkhead behind the continuous ceiling or lining shall be of 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 the Administration*; and (SOLAS II-2/9.2.2.2.2.1)

*** *IMO interpretation***

The extension of the bulkhead should be made of non-combustible material and the construction of the extension should correspond to the fire class of extended bulkhead. If the extended bulkhead is of "B-0", then the extension may be made of thin steel plates of 1 mm thickness and tightened (e.g. with mineral wool). Alternatively, "B-0" class extensions may be constructed of a suitably supported mineral wool (density at least 100 kg/m^3, thickness at least 50 mm). (MSC/Circ.1120)

.2 in the case of a ship protected by an automatic sprinkler system complying with the provisions of sub-chapter 3.3 (*FSS Code*), the corridor bulkheads may terminate at a ceiling in the corridor provided such bulkheads and ceilings are of "B" class standard in compliance with sec. 11.1.2.4 (SOLAS par. 2.2.4). All doors and frames in such bulkheads shall be of non-combustible materials and shall have the same fire integrity as the bulkhead in which they are fitted. (SOLAS II-2/9.2.2.2.2.2)

11.1.2.2.3 Bulkheads required to be "B" class divisions, except corridor bulkheads as prescribed in sec. 11.1.2.2 (SOLAS par. 2.2.2.2), shall extend from deck to deck and to the shell or other boundaries. However, where a continuous "B" class ceiling or lining is fitted on both sides of a bulkhead which is at least of the same fire resistance as the adjoining bulkhead, the bulkhead may terminate at the continuous ceiling or lining.* (SOLAS II-2/9.2.2.2.3)

***** IACS interpretation***

If an air gap between cabins results in an opening in the continuous class "B-15" ceiling, the bulkheads on both sides of the air gap are to be of class "B-15". (IACS UI SC107)

***** IMO interpretation***

Examples of arrangements see MSC/Circ.917 (MCS/Circ.1120)

11.1.2.3 Fire integrity of bulkheads and decks in ships carrying more than 36 passengers

11.1.2.3.1 In addition to complying with the specific provisions for fire integrity of bulkheads and decks of passenger ships, the minimum fire integrity of all bulkheads and decks shall be as prescribed in tables 9.1 and 9.2. 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 divisions, such values shall be determined to the satisfaction of the Administration. (SOLAS II-2/9.2.2.3.1)

11.1.2.3.2 The following requirements shall govern application of the tables:

.1 Table 9.1 shall apply to bulkheads not bounding either main vertical zones or horizontal zones. Table 9.2 shall apply to decks not forming steps in main vertical zones nor bounding horizontal zones;

.2 For determining the appropriate fire integrity standards to be applied to boundaries between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (14) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this sub-chapter 11.1 (regulation), or where it is possible to assign two or more classifications to a space, it shall be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30% communicating openings to that space are considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms shall be as prescribed in tables 9.1 and 9.2. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables.

(1) Control stations:

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

***** IMO interpretation***

A bulkhead separating the wheelhouse and the toilet, installed completely within the wheelhouse, requires no fire rating. (MCS.1/Circ.1555)

**** IACS interpretation***

Navigation equipment room (radar transmitter) and battery rooms should be treated as category (1): Control Stations. (IACS UI SC45)

(2) Stairways

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

(3) Corridors

- Passenger and crew corridors and lobbies.

(4) Evacuation stations and external escape routes

- Survival craft stowage area.
- Open deck spaces and enclosed promenades forming lifeboat and liferaft embarkation and lowering stations.
- Assembly stations, internal and external.
- External stairs and open decks used for escape routes.
- The ship's side to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the liferaft and evacuation slide embarkation areas.

(5) Open deck spaces

- 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 space outside superstructures and deckhouses).

(6) Accommodation spaces of minor fire risk

- Cabins containing furniture and furnishings of restricted fire risk.
- Offices and dispensaries containing furniture and furnishings of restricted fire risk.
- Public spaces containing furniture and furnishings of restricted fire risk and having a deck area of less than 50 m^2.

(7) Accommodation spaces of moderate fire risk**

- Spaces as in category (6) above but containing furniture and furnishings of other than restricted fire risk.
- Public spaces containing furniture and furnishings of restricted fire risk and having a deck area of 50 m^2 or more.
- Isolated lockers and small store-rooms in accommodation spaces having areas less than 4 m^2 (in which flammable liquids are not stowed).
- Motion picture projection and film stowage rooms.
- Diet kitchens (containing no open flame).*

**** IMO interpretation***

Diet kitchens (containing no open flame) should be in compliance with the interpretation for pantries as stated under par. 1.2.1 (SOLAS reg. 3.1). (MCS/Circ.1120, MSC.1/Circ.1436)

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

- Pharmacies.
- Small drying rooms (having a deck area of 4 m^2 or less).
- Specie rooms.
- Operating rooms.

*** IACS and IMO interpretation***

Distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provision is made for storage.

If distribution boards are located in an identifiable space having a deck area of less than 4 m^2, this space may be categorized in (7), according to par. 11.1.2.3.2 (SOLAS reg. 9.2.2.3.2.2). (IACS UI SC167, MSC/Circ.1120)

(8) Accommodation spaces of greater fire risk

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

(9) Sanitary and similar spaces

- Communal sanitary facilities, showers, baths, water closets, etc.
- Small laundry rooms.
- Indoor swimming pool area.
- Isolated pantries* containing no cooking appliances in accommodation spaces.

** IMO interpretations*

Pantries or isolated pantries containing no cooking appliances may contain:

.1 toasters, microwave ovens, water boilers, induction heaters and similar appliances each of them with a maximum power of 5 kW; and

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

These pantries may also contain coffee machines, dish washers and water boilers with no exposed hot surfaces regardless of their power.

A dining room containing such appliances should not be regarded as a pantry. (MSC/Circ.1120, MSC.1/Circ.1436)

"Isolated pantries containing no cooking appliances in accommodation spaces" are pantries enclosed in an accommodation space and are only accessible from accommodation spaces and/or open deck. For the purpose of this categorization, "accommodation space" is as defined in par. 1.2.1 (SOLAS reg. II-2/3.1). These pantries, shown in figure 1 of MSC.1/Circ.1634, should not have communicating openings to spaces other than accommodation spaces, such as a category 12 "main galley". These pantries do not contain cooking appliances, except as allowed in accordance with MSC/Circ.1120 and MSC.1/Circ.1436, as above. (MSC.1/Circ.1634)

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

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

- Water tanks forming part of the ship's structure.
- Voids and cofferdams.
- Auxiliary machinery spaces which do not contain machinery having a pressure lubrication system and where storage of combustibles is prohibited, such as:
  - ventilation and air-conditioning rooms;
  - windlass room;
  - steering gear room;
  - stabilizer equipment room;

  – electrical propulsion motor room;
  – rooms containing section switchboards and purely electrical equipment other than oil-filled electrical transformers (above 10 kVA);
  – shaft alleys and pipe tunnels;
  – spaces for pumps and refrigeration machinery (not handling or using flammable liquids).
- Closed trunks serving the spaces listed above.
- Other closed trunks such as pipe and cable trunks.

*** IACS and IMO interpretation**

In cases where urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS) are installed in a space separated from the engine-room, in determining fire integrity of divisions, the solution tank space should be considered as "similar spaces" in the definition of "machinery spaces" in par. 1.2.30 (SOLAS reg. 3.30) and should be categorized as (10).

The division between the engine-room and the solution tank space should have a fire integrity of at least "A-0" class. (IACS UI SC294, MSC.1/Circ.1616)

(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).
- Shaft alleys and pipe tunnels allowing storage of combustibles.
- Auxiliary machinery spaces as in category (10) which contain machinery having a pressure lubrication system or where storage of combustibles is permitted.
- Oil fuel filling stations.
- Spaces containing oil-filled electrical transformers (above 10 kVA).
- Spaces containing turbine and reciprocating steam engine driven auxiliary generators and small internal combustion engines of power output up to 110 kW driving generators, sprinkler, drencher or fire pumps, bilge pumps, etc.
- Closed trunks serving the spaces listed above.

(12) Machinery spaces and main galleys

- Machinery spaces of category A, 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.

*** IMO interpretations**

Main pantries and pantries containing cooking appliances may contain:

.1 toasters, microwave ovens, induction heaters and similar appliances each of them with a power of more than 5 kW; and

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

These pantries may also contain coffee machines, dish washers and water boilers with no exposed hot surfaces regardless of their power.

Spaces containing any electrically heated cooking plate or hot plate for keeping food warm with a power of more than 5 kW should be regarded as galleys. (MSC/Circ.1120, MSC.1/Circ.1436)

- Main laundry.
- Large drying rooms (having a deck area of more than 4 m^2)
- Miscellaneous stores.
- Mail and baggage rooms.
- Garbage rooms.
- Workshops (not part of machinery spaces, galleys, etc.).
- Lockers and store-rooms having areas greater than 4 m^2, other than those spaces that have provisions for the storage of flammable liquids.

(14) Other spaces in which flammable liquids are stowed

- Paint lockers.
- Store-rooms containing flammable liquids (including dyes, medicines, etc.).
- Laboratories (in which flammable liquids are stowed);

.3 Where a single value is shown for the fire integrity of a boundary between two spaces, that value shall apply in all cases;

.4 Notwithstanding the provisions of sec. 11.1.2.2 (SOLAS par. 2.2.2) there are no special requirements for material or integrity of boundaries where only a dash appears in the tables; and

.5 The Administration shall determine in respect of category (5) spaces whether the insulation values in table 9.1 shall apply to ends of deckhouses and superstructures, and whether the insulation values in table 9.2 shall apply to weather decks. In no case shall the requirements of category (5) of tables 9.1 or 9.2 necessitate enclosure of spaces which in the opinion of the Administration need not be enclosed. (SOLAS II-2/9.2.2.3.2)

Table 9.1
Fire integrity of bulkheads separating adjacent spaces (not bounding either main vertical zones or horizontal zones)

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

Table 9.2
Fire integrity of decks separating adjacent spaces (not forming steps in main vertical zones nor bounding horizontal zones)

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

Notes: To be applied to tables 9.1 and 9.2, as appropriate

a) Where adjacent spaces are in the same numerical category and superscript "a" appears, a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Administration. 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".

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

d) Where spaces of categories (6), (7), (8) and (9) are located completely within the outer perimeter of the assembly station, the bulkheads of these spaces are allowed to be of "B-0" class integrity. Control positions for audio, video and light installations may be considered as part of the assembly station. (SOLAS II-2/9.2.2.3.2)

11.1.2.3.3 Continuous "B" class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing wholly or in part, to the required insulation and integrity of a division. (SOLAS II-2/9.2.2.3.3)

11.1.2.3.4 Construction and arrangement of saunas

11.1.2.3.4.1 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). (SOLAS II-2/9.2.2.3.4.1)

11.1.2.3.4.2 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. (SOLAS II-2/9.2.2.3.4.2)

11.1.2.3.4.3 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). (SOLAS II-2/9.2.2.3.4.3)

11.1.2.3.4.4 The traditional wooden benches are permitted to be used in the sauna. (SOLAS II-2/9.2.2.3.4.4)

11.1.2.3.4.5 The sauna door shall open outwards by pushing. (SOLAS II-2/9.2.2.3.4.5)

11.1.2.3.4.6 Electrically heated ovens shall be provided with a timer. (SOLAS II-2/9.2.2.3.4.6)

11.1.2.4 Fire integrity of bulkheads and decks in ships carrying not more than 36 passengers

11.1.2.4.1 In addition to complying with the specific provisions for fire integrity of bulkheads and decks of passenger ships, the minimum fire integrity of bulkheads and decks shall be as prescribed in tables 9.3 and 9.4. (SOLAS II-2/9.2.2.4.1)

11.1.2.4.2 The following requirements govern application of the tables:

.1 Tables 9.3 and 9.4 shall apply respectively to the bulkheads and decks separating adjacent spaces;

.2 For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (11) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this sub-chapter 11.1 (regulation), or where it is possible to assign two or more classifications to a space, it shall be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30 % communicating openings to that space are considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms shall be as prescribed in tables 9.3 and 9.4.

The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables.

(1) Control stations*:

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

***** ***IACS and IMO interpretations***

A bulkhead separating the wheelhouse and the toilet, installed completely within the wheelhouse, requires no fire rating. (MCS.1/Circ.1555)

A navigation locker that can only be accessed from the wheelhouse should be considered as a control station with respect to the requirements in 9.3 and the bulkhead separating the wheelhouse and such a locker should have fire integrity of at least "B-0" class. (MSC.1/Circ.1581)

Navigation equipment room (radar transmitter) and battery rooms should be treated as category (1): Control Stations. (IACS UI SC45)

(2) Corridors

- Passenger and crew corridors and lobbies.

(3) Accommodation spaces*

- Spaces as defined in par.1.2.1 (SOLAS reg. 3.1) excluding corridors.

***** ***IMO interpretations***

Pantries or isolated pantries containing no cooking appliances may contain:

.1 toasters, microwave ovens, water boilers, induction heaters and similar appliances each of them with a maximum power of 5 kW; and

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

These pantries may also contain coffee machines, dish washers and water boilers with no exposed hot surfaces regardless of their power.

A dining room containing such appliances should not be regarded as a pantry. (MSC/Circ.1120, MSC.1/Circ.1436)

(4) Stairways

- Interior stairways, lifts, totally enclosed emergency escape trunks, and escalators (other than those wholly contained within the machinery spaces) for passengers and crew and enclosures thereto.

  In this connection, a stairway which is enclosed only at one level shall be regarded as part of the space from which it is not separated by a fire door.

(5) Service spaces (low risk)*

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

***** ***IACS and IMO interpretations***

Distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provision is made for storage.

If distribution boards are located in an identifiable space having a deck area of less than 4 m^2, this space may be categorized in (5). (IACS UI SC167, MSC/Circ.1120)

Provision chambers are to be treated as store rooms.

Refrigerated provision chambers are to be category (5) service spaces if thermally insulated with non-combustible materials. (IACS UI SC45)

(6) Machinery spaces of category A

- Spaces as defined in par.1.2.31 (SOLAS reg. 3.31).

(7) Other machinery spaces*

- Electrical equipment rooms (auto-telephone exchange, air-conditioning duct spaces).
- Spaces as defined in par.1.2.30 (SOLAS reg. 3.30) excluding machinery spaces of category A.

**** IACS and IMO interpretation***

In cases where urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS) are installed in a space separated from the engine-room, in determining fire integrity of divisions, the solution tank space should be considered as "similar spaces" in the definition of "machinery spaces" in par.1.2.30 (SOLAS reg. 3.30) and should be categorized as (10).

The division between the engine-room and the solution tank space should have a fire integrity of at least "A-0" class. (IACS UI SC294, MSC.1/Circ.1616)

(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 risk)*

- Galleys;
- Pantries containing cooking appliances**,

  ***** IMO interpretations***

  Main pantries and pantries containing cooking appliances may contain:

  .1 toasters, microwave ovens, induction heaters and similar appliances each of them with a power of more than 5 kW; and

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

  These pantries may also contain coffee machines, dish washers and water boilers with no exposed hot surfaces regardless of their power.

  Spaces containing any electrically heated cooking plate or hot plate for keeping food warm with a power of more than 5 kW should be regarded as galleys. (MSC/Circ.1120, MSC.1/Circ.1436)
- Paint and lamp rooms,
- Lockers and store-rooms having areas of 4 m^2 or more, spaces for the storage of flammable liquids, saunas and workshops other than those forming part of the machinery spaces.

**** IACS and IMO interpretations***

Provision chambers are to be treated as store rooms.

Refrigerated provision chambers are to be category (9) service spaces if thermally insulated with combustible materials. (IACS UI SC45)

(10) Open decks

- Open deck spaces and enclosed promenades having little or no fire risk.

Enclosed promenades should have no significant fire risk, meaning that furnishing should be restricted to deck furniture. In addition, such spaces should be naturally ventilated by permanent openings.

- Air spaces (the space outside superstructures and deckhouses).

(11) Special category and ro-ro spaces

- Spaces as defined in par.1.2.41 and 1.2.46 (SOLAS reg. 3.41 and 3.46);

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

.4 In determining the applicable fire integrity standard of a boundary between two spaces within a main vertical zone or horizontal zone which is protected by an automatic sprinkler system complying with the provisions of the *FSS Code* or between such zones both of which are so protected, the lesser of the two values given in the tables shall apply. Where a zone with sprinklers and a zone without sprinklers meet within accommodation and service spaces, the higher of the two values given in the tables shall apply to the division between the zones. (SOLAS II-2/9.2.2.4.2)

11.1.2.4.3 Continuous "B" class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing, wholly or in part, to the required insulation and integrity of a division. (SOLAS II-2/9.2.2.4.3)

11.1.2.4.4 External boundaries which are required in par. 2.1.1 (SOLAS reg. 11.2) to be of steel or other equivalent material may be pierced for the fitting of windows and sidescuttles provided that there is no requirement for such boundaries of 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 which are to the satisfaction of the Administration. (SOLAS II-2/9.2.2.4.4)

11.1.2.4.5 Saunas* shall comply with par. 11.1.2.3.4 (SOLAS par. 2.2.3.4). (SOLAS II-2/9.2.2.4.5)

**** IMO interpretation***

The space categories mentioned in par. 11.1.2.3.4.1 (SOLAS reg. 9.2.2.3.4.1) should be replaced, when applying this sub-chapter 11.1 (regulation), by (5), (7) and (10). (MSC/Circ.1120)

Table 9.3
Fire integrity of bulkheads separating adjacent spaces

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

Table 9.4
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-60
Corridors	(2)	A-0	*	*	A-0	*	A-60	A-0	A-0	A-0	*	A-30
Accommodation spaces	(3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0	A-0	*	A-30 A-0[d)]
Stairways	(4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0	A-0	*	A-30
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[f)]	A-30	A-60	*	A-60
Other machinery spaces	(7)	A-15	A-0	A-0	A-0	A-0	A-0	*	A-0	A-0	*	A-0
Cargo spaces	(8)	A-60	A-0	A-0	A-0	A-0	A-0[d)]	A-0	*	A-0	*	A-0
Service spaces (high fire risk)	(9)	A-60	A-30 A-0[d)]	A-30 A-0[d)]	A-30 A-0[d)]	A-0	A-60	A-0	A-0	A-0	*	A-30
Open decks	(10)	*	*	*	*	*	*	*	*	*	–	A-0
Special category spaces and ro-ro spaces	(11)	A-60	A-30	A-30 A-0[d)]	A-30	A-0	A-60	A-0	A-0	A-30	A-0	A-30

Notes: To be applied to both tables 9.3 and 9.4 as appropriate.

a) For clarification as to which applies, see sec. 11.1.2.2 and 11.1.2.5 (SOLAS par. 2.2.2 and 2.2.5).

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

c) Bulkhead separating the wheelhouse and chartroom from each other may have a "B-0" rating. No fire rating is required for those partitions separating the navigation bridge and the safety centre when the latter is within the navigation bridge.

d) See par. 11.1.2.4.2.3 and 11.1.2.4.2.4 (SOLAS par. 2.2.4.2.3 and 2.2.4.2.4).

e) For the application of par. 11.1.2.1.1.2 (SOLAS par. 2.2.1.1.2), "B-0" and "C", where appearing in table 9.3, shall be read as "A-0".

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

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

For the application of par. 11.1.2.1.1.2 (SOLAS par. 2.2.1.1.2), an asterisk, where appearing in table 9.4, except for categories (8) and (10), shall be read as "A-0".

11.1.2.5 Protection of stairways and lifts in accommodation area

11.1.2.5.1 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 ' tween-deck space. When a stairway is closed in one 'tween-deck space, the stairway enclosure shall be protected in accordance with the tables for decks in sec. 11.1.2.3 or 11.1.2.4 (SOLAS par. 2.2.3 or 2.2.4); and
- **.2** stairways may be fitted in the open in a public space, provided they lie wholly within the public space. (SOLAS II-2/9.2.2.5.1)

11.1.2.5.2 Lift trunks shall be so fitted as to prevent the passage of smoke and flame from one ' tween-deck to another and shall be provided with means of closing so as to permit the control of draught and smoke. Machinery for lifts located within stairway enclosures shall be arranged in a separate room, surrounded by steel boundaries, except that small passages for lift cables are permitted. Lifts which open into spaces other than corridors, public spaces, special category spaces, stairways and external areas shall not open into stairways included in the means of escape. (SOLAS II-2/9.2.2.5.2)

11.1.2.6 Arrangement of cabin balconies

Non-load bearing partial bulkheads which separate adjacent cabin balconies shall be capable of being opened by the crew from each side for the purpose of fighting fires. (SOLAS II-2/9.2.2.6)

11.1.2.7 Protection of atriums

11.1.2.7.1 Atriums shall be within enclosures formed of "A" class divisions having a fire rating determined in accordance with table 9.1 and 9.3, as applicable. (SOLAS II-2/9.2.2.7.1)

11.1.2.7.2 Decks separating spaces within atriums shall have a fire rating determined in accordance with tables 9.2 and 9.4, as applicable. (SOLAS II-2/9.2.2.7.2)

11.1.3 Protection of openings in fire resisting divisions

11.1.3.1 Openings in "A" class divisions

11.1.3.1.1 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. (SOLAS II-2/9.4.1.1.1)

11.1.3.1.2 The construction of doors and door frames in "A" class divisions, with the means of securing them when closed, shall provide resistance to fire as well as to the passage of smoke and flame equivalent to that of the bulkheads in which the doors are situated*, this being determined in accordance with *FTP Code*. Doors approved without the sill being part of the frame, shall be installed such that the gap under the door does not exceed 12 mm. A non-combustible sill shall be installed under the door such that floor coverings do not extend beneath the closed door. (SOLAS II-2/9.4.1.1.2)

IMO interpretation

Where required divisions are replaced by divisions of a higher standard, the door need only conform to the required division. (MSC/Circ.1120)

11.1.3.1.3 Such doors and door frames shall be constructed of steel or other equivalent material. Watertight doors need not be insulated*. (SOLAS II-2/9.4.1.1.3)

IACS and IMO interpretations

Watertight doors may also serve as fire doors but need not be fire-tested notwithstanding the fire resistance of the division in which the watertight doors are fitted. However, such doors fitted above the bulkhead deck on passenger ships shall be tested to the FTP Code in accordance with the division they are fitted. If it is not practicable to ensure self-closing, means of indication on the bridge showing whether these doors are open or closed and a notice stating 'To be kept closed at sea' can be alternative of the self-closing.

Where a watertight door is located adjacent to a fire door, both doors shall be capable of independent operation, remotely if required by SOLAS ll-1/13.8.1 to 13.8.3 and from both sides of each door. (IACS UI SC156, par.4)

The door (dual function: fire and watertight) must be capable of operation using both the remote fire door control circuit and the remote watertight door control circuit.

If two doors are fitted, they must be capable of independent operation. The operation of either door separately must not preclude closing of the other door. (Res. MSC.429(98)/Rev.1, Reg. II-1/17.1, par.4)

11.1.3.1.4 It shall be possible for each door to be opened and closed from each side of the bulkhead by one person only. (SOLAS II-2/9.4.1.1.4)

11.1.3.1.5 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 degrees opposing closure;

.2 the approximate time of closure for hinged fire doors shall be no 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 the doors, except those for emergency escape trunks, shall be capable of remote release from the continuously manned central control station, either simultaneously or in groups and shall be capable of release also individually from a position at both sides of the door. Release switches shall have an on-off function to prevent automatic resetting of the system;

.4 hold-back hooks not subject to central control station release are prohibited;

.5 a 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 continuously manned central control station whether each door is closed*;

**** IMO interpretation***

Lift door indication signals should meet the following:

.1 the signal showing that "A" class lift doors are in the closed position should be activated only when the order to close the main fire doors has been given by the continuously manned central control station;

.2 when there are several lifts giving access to the same stairway, the lift door indicators located in the continuously manned central control station should be capable of indicating that all the lift doors giving access to the same landing are properly closed. This indication should be shown on the panel; and

.3 when an order to close the main fire doors is given, the same order should also stop the lifts from operating by sending them to a pre-specified deck, to be determined on a case-by-case basis according to the ship's design. In addition, those inside the lift should be able to order the lift doors open while those outside the lift should not be able to do so. *(MSC/Circ.1120)*

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

.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 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 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 par. 11.1.3.1.5.3 and 11.1.3.1.5.10 (SOLAS par. 4.1.1.5.3 and 4.1.1.5.10);

.14 the components of the local control system shall be accessible for maintenance and adjusting;

.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:

.15.1 the 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;

.15.2 the power supply for all other doors not subject to fire shall not be impaired; and

.15.3 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. (SOLAS II-2/9.4.1.1.5)

11.1.3.1.6 In ships carrying not more than 36 passengers, where a space is protected by an automatic sprinkler fire detection and alarm system complying with the provisions of sub-chapter 3.3 (*FSS Code*) or fitted with a continuous "B" class ceiling, openings in decks not forming steps in main vertical zones nor bounding horizontal zones shall be closed reasonably tight and such decks shall meet the "A" class integrity requirements in so far as is reasonable and practicable in the opinion of the Administration. (SOLAS II-2/9.4.1.1.6)

11.1.3.1.7 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 par. 11.1.3.3.3 and 11.1.3.3.4 (SOLAS par. 4.1.3.3). 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. (SOLAS II-2/9.4.1.1.7)

11.1.3.1.8 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, and shall be a 150 mm square clear opening with the door closed and shall be inset into the lower edge of the door, opposite the door hinges or, in the case of sliding doors, nearest the opening. (SOLAS II-2/9.4.1.1.8)

11.1.3.1.9 Where it is necessary that a ventilation duct passes through a main vertical zone division, a fail-safe automatic closing fire damper shall be fitted adjacent to the division. The damper shall also be capable of being manually closed from each side of the division*. The operating position shall be readily accessible and be marked in red light-reflecting colour. The duct between the division and the damper shall be of steel or other equivalent material and, if necessary, insulated to comply with the requirements of par. 2.2.6.3 (SOLAS par. 3.1). The damper shall be fitted on at least one side of the division with a visible indicator showing whether the damper is in the open position. (SOLAS II-2/9.4.1.1.9)

*** *IMO interpretation***

Manual closing may be achieved by mechanical means of release or by remote operation of the fire damper by means of a fail-safe electrical switch or pneumatic release (spring-loaded, etc.) on both sides of the division. (MSC/Circ.1120)

11.1.3.2 Openings in "B" class divisions*

*** *IACS interpretation***

Balancing openings or ducts between two enclosed spaces are prohibited except for openings as permitted by this sec. 11.1.3.2. (SOLAS Reg. II-2/9.4.1.2 and Reg. II-2/9.4.2). (IASC UI SC119)

11.1.3.2.1 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 *FTP Code* except that ventilation openings may be permitted in the lower portion of such doors. Where such opening is in or under a door the total net area of any such opening or openings shall not exceed 0.05 m^2. Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, and located below the sanitary unit is permitted where the cross-sectional area of the duct does not exceed 0.05 m^2. All ventilation openings shall be fitted with a grill made of non-combustible material. Doors shall be non-combustible. Doors approved without the sill being part of the frame, shall be installed such that the gap under the door does not exceed 25 mm. (SOLAS II-2/9.4.1.2.1)

11.1.3.2.2 Cabin doors in "B" class divisions shall be of a self-closing type. Hold-back hooks are not permitted. (SOLAS II-2/9.4.1.2.2)

11.1.3.2.3 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 Administration may permit the use of combustible materials in doors separating cabins from the individual interior sanitary spaces such as showers. (SOLAS II-2/9.4.1.2.3)

11.1.3.2.4 In ships carrying not more than 36 passengers, where an automatic sprinkler system complying with the provisions of sub-ch. 3.3 *(FSS Code)* 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 the "B" class integrity requirements in so far as is reasonable and practicable in the opinion of the Administration; and

.2 openings in corridor bulkheads of "B" class materials shall be protected in accordance with the provisions of sec. 11.1.2.2. (SOLAS par. 2.2.2). (SOLAS II-2/9.4.1.2.4)

11.1.3.3 Windows and sidescuttles*

* Reference is made to the following ISO standards:

ISO 614:1989	*Shipbuilding and marine structures - Toughened safety glass panes for rectangular windows and side scuttles - Punch method of non-destructive strength testing*
ISO 1095:1989	*Shipbuilding and marine structures - Toughened safety glass panes for side scuttles*
ISO 1751:1993	*Shipbuilding and marine structures - Ship's side scuttles*
ISO 3254:1989	*Shipbuilding and marine structures - Toughened safety glass panes for rectangular windows*
ISO 3903:1993	*Shipbuilding and marine structures - Ships' ordinary rectangular windows*
ISO 3904:1990	*Shipbuilding and marine structures - Clear view screens (MSC/Circ.1120)*

11.1.3.3.1 Windows and sidescuttles in bulkheads within accommodation and service spaces and control stations other than those to which the provisions of par. 11.1.3.1.7 and 11.1.3.2.3 (SOLAS par. 4.1.1.7 and 4.1.2.3) 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*. (SOLAS II-2/9.4.1.3.1)

11.1.3.3.2 Notwithstanding the requirements of tables 9.1 to 9.4, 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. (SOLAS II-2/9.4.1.3.1)

11.1.3.3.3 For ships carrying more than 36 passengers, windows facing survival craft, embarkation and assembly stations, external stairs and open decks used for escape routes, and windows situated below liferaft and escape slide embarkation areas shall have fire integrity as required in table 9.1. Where automatic dedicated sprinkler heads are provided for windows, "A-0" windows may be accepted as equivalent. To be considered under this paragraph, the sprinkler heads must either be:

.1 dedicated heads located above the windows, and installed in addition to the conventional ceiling sprinklers; or

.2 conventional ceiling sprinkler heads arranged such that the window is protected by an average application rate of at least 5 l/min per square metre and the additional window area is included in the calculation of the area of coverage; or

.3 water-mist nozzles that have been tested and approved in accordance with the Guidelines approved by the Organization *; and

* Refer to the *Revised guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS reg. II-2/12* (resolution A.800(19), as amended).

Windows located in the ship's side below the lifeboat embarkation area shall have fire integrity at least equal to "A-0" class. (SOLAS II-2/9.4.1.3.5)

11.1.3.3.4 For ships carrying not more than 36 passengers, windows facing survival craft and escape slide, embarkation areas and windows situated below such areas shall have fire integrity at least equal to "A-0" class. (SOLAS II-2/9.4.1.3.6)

11.1.3.4 Protection of openings in machinery spaces boundaries

11.1.3.4.1 In passenger ships, the means of control for closing power-operated doors or actuating release mechanisms on doors other than power-operated watertight doors required in par. 2.1.4.3.2.3 (SOLAS par. 5.2.3) shall be situated at one control position or grouped in as few positions as possible to the satisfaction of the Administration. Such positions shall have safe access from the open deck. (SOLAS II-2/9.5.2.4)

11.1.3.4.2 In passenger ships, doors, other than power-operated watertight doors shall be so arranged that positive closure is assured in case of fire in the space by power-operated closing arrangements or by the provision of self-closing doors capable of closing against an inclination of 3.5 degrees 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. (SOLAS II-2/9.5.2.5)

11.1.3.5 Exhaust ducts from galley ranges* for passenger ships carrying more than 36 passengers

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*** *IACS interpretation***

The requirements to exhaust ducts from galley ranges in which grease or fat is likely to accumulate will apply to all exhaust ducts from galley ranges. (IASC UI SC108)

11.1.3.5.1 In addition to the requirements in sec. 7.2, 7.3 and 7.4 of *Part VI*, (SOLAS sec. 7.1, 7.2 and 7.3), exhaust ducts from galley ranges shall be constructed in accordance with par. 7.3.4.2.1 and 7.3.4.2.2 of Part *VI*, (SOLAS par. 7.2.4.2.1 and 7.2.4.2.2) and insulated to "A-60" class standard throughout accommodation spaces, service spaces, or control stations they pass through*. They shall also be fitted with:

.1 a grease trap readily removable for cleaning unless an alternative approved grease removal system is fitted;

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

IACS interpretations

* *The requirements to "A" class applies only to the part of the duct outside of the galley. (IASC UI SC118)*

** *Fire dampers required by* this par. *(SOLAS Reg. II-2/9.7.5.1.1 and 9.7.5.2.1) do not need to pass the fire test in either Res. A.754(18) or Appendix 2 of Part 3, of Annex 1 of the 2010 FTP Code, but should be of steel and capable of stopping the draught. The requirements to "A" class applies only to the part of the duct outside of the galley. (IASC UI SC118)*

.3 a fixed means for extinguishing a fire within the duct *;

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* Refer to the recommendations published by the International Organization for Standardization, in particular publication *ISO 15371:2009, Ships and marine technology – Fire-extinguishing systems for protection of galley cooking equipment.*

*** IMO interpretation**

The reference to ISO 15371:2009 in the footnote to this par. *(both SOLAS reg. 9.7.5.1.1.3 and 9.7.5.2.4) is given as an example of a suitable performance standard for pre-engineered galley duct fixed fire-extinguishing systems.*

CO_2 fire-extinguishing systems, which are not pre-engineered fixed fire-extinguishing systems, should be designed according to the requirements set out in SOLAS reg. 10.6.3.1.1 (spaces containing flammable liquids) or another suitable standard acceptable to the Administration. (MSC.1/Circ.1616)

.4 remote-control arrangements for shutting off the exhaust fans and supply fans, for operating the fire dampers mentioned in par.11.1.3.5.1.2 (SOLAS par. 7.5.1.1.2) and for operating the fire-extinguishing system, which shall be placed in a position outside the galley close to the entrance to the galley. Where a multi-branch system is installed, a remote means located with the above controls shall be provided to close all branches exhausting through the same main duct before an extinguishing medium is released into the system; and

.5 suitably located hatches for inspection and cleaning, including one provided close to the exhaust fan and one fitted in the lower end where grease accumulates. (SOLAS II-2/9.7.5.1.1)

11.1.3.5.2 Exhaust ducts from ranges for cooking equipment installed on open decks shall conform to par. 11.1.3.5.1 (SOLAS par. 7.5.1.1), as applicable, when passing through accommodation spaces or spaces containing combustible materials. (SOLAS II-2/9.7.5.1.2)

11.1.3.6 Exhaust ducts from galley ranges for passenger ships carrying not more than 36 passengers

Exhaust ducts from galley ranges shall comply with the same requirements as for cargo ships, see sec. 6.4.1.2. (SOLAS II-2/9.7.5.2)

11.1.3.7 Ventilation systems for laundries in passenger ships carrying more than 36 passengers

Exhaust ducts from laundries and drying rooms of category (13) spaces as defined in par. 11.1.2.3.2.2 (SOLAS par. 2.2.3.2.2) shall be fitted with:

.1 filters readily removable for cleaning purposes;

.2 a fire damper located in the lower end of the duct which is automatically and remotely operated;

.3 remote-control arrangements for shutting off the exhaust fans and supply fans from within the space and for operating the fire damper mentioned in sub-par. 2. (SOLAS par. 7.7.2); and

.4 suitably located hatches for inspection and cleaning. (SOLAS II-2/9.7.7)

11.1.4 Means of escape in passenger ships

11.1.4.1 Notification of crew and passengers

11.1.4.1.1 Public address systems in passenger ships

A public address system or other effective means of communication complying with the requirements of *Part VIII*, sec. 21.1.5 (SOLAS reg. III/6.5) shall be provided to enabling passengers and crew safe evacuation in first stage of fire. The system shall be available throughout the accommodation and service spaces and control stations and open decks. (SOLAS II-2/12.3)

11.1.4.2 Arrangement of means of escape

11.1.4.2.1 Basic requirements for stairway width

Stairways shall not be less than 900 mm in clear width. The minimum clear width of stairways shall be increased by 10 mm for every one person provided for in excess of 90 persons. The total number of persons to be evacuated by such stairways shall be assumed to be two thirds of the crew and the total number of passengers in the areas served by such stairways. The width of the stairways shall not be inferior to those determined by sec. 11.1.4.2.2 (FSS Code, Ch. 13 par. 2.1.2). (FSS Code, Ch. 13, par. 2.1.1)

11.1.4.2.2 Calculation method of stairway width

11.1.4.2.2.1 Basic principles of the calculation

11.1.4.2.2.1.1 This calculation method determines the minimum stairway width at each deck level, taking into account the consecutive stairways leading into the stairway under consideration. (FSS Code, Ch. 13, par. 2.1.2.1.1)

11.1.4.2.2.1.2 It is the intention that the calculation method shall consider evacuation from enclosed spaces within each main vertical zone individually and take into account all of the persons using the stairway enclosures in each zone, even if they enter that stairway from another vertical zone. (FSS Code, Ch. 13, par. 2.1.2.1.2)

11.1.4.2.2.1.3 For each main vertical zone the calculation shall be completed for the night time (case 1) and day time (case 2) and the largest dimension from either case used for determining the stairway width for each deck under consideration. (FSS Code, Ch. 13, par. 2.1.2.1.3)

11.1.4.2.2.1.4 The calculation of stairway widths shall be based upon the crew and passenger load on each deck. Occupant loads shall be rated by the designer for passenger and crew accommodation spaces, service spaces, control spaces and machinery spaces. For the purpose of the calculation the maximum capacity of a public space shall be defined by either of the following two values: the number of seats or similar arrangements, or the number obtained by assigning 2 m^2 of gross deck surface area to each person. (FSS Code, Ch. 13, par. 2.1.2.1.4)

11.1.4.2.2.2 Calculation method for minimum value

11.1.4.2.2.2.1 Basic formulae

In considering the design of stairway widths for each individual case which allow for the timely flow of persons evacuating to the muster stations from adjacent decks above and below, the following calculation methods shall be used (see figures 1 and 2):

when joining two decks: $W=(N_1+N_2)$ 10 mm;

when joining three decks: $W=(N_1+N_2+0.5\ N_3)$ 10 mm;

when joining four decks: $W=(N_1+N_2+0.5\ N_3+0.25\ N_4)$ 10 mm;

When joining five decks or more decks, the width of the stairways shall be determined by applying the above formula for four decks to the deck under consideration and to the consecutive deck, where:

W = the required tread width between handrails of the stairway.

The calculated value of W may be reduced where available landing area S is provided in stairways at the deck level defined by subtracting P from Z, such that:

$P = S \times 3.0$ persons/m^2 ; and Pmax = 0.25 Z

where:

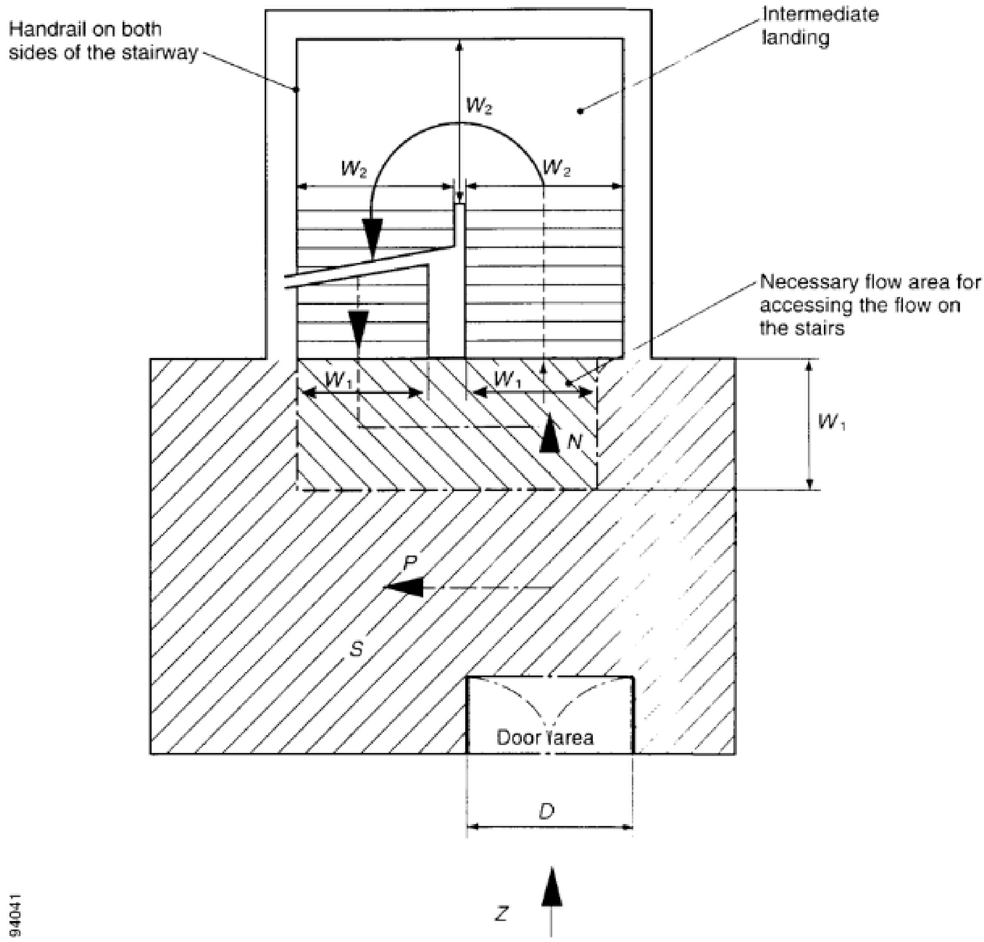
Z = the total number of persons expected to be evacuated on the deck being considered;

P = the number of persons taking temporary refuge on the stairway landing, which may be subtracted from Z to a maximum value of $P = 0.25\ Z$ (to be rounded down to the nearest whole number) ;

S = the surface area (m^2) of the landing, minus the surface area necessary for the opening of doors and minus the surface area necessary for accessing the flow on stairs (see figure 1);

N = the total number of persons expected to use the stairway from each consecutive deck under consideration;

Figure 1 - Landing calculation for stairway width reduction



P = $S \times 3$ persons/m^2 = the number of persons taking refuge on the landing to a maximum of $P = 0.25Z$;

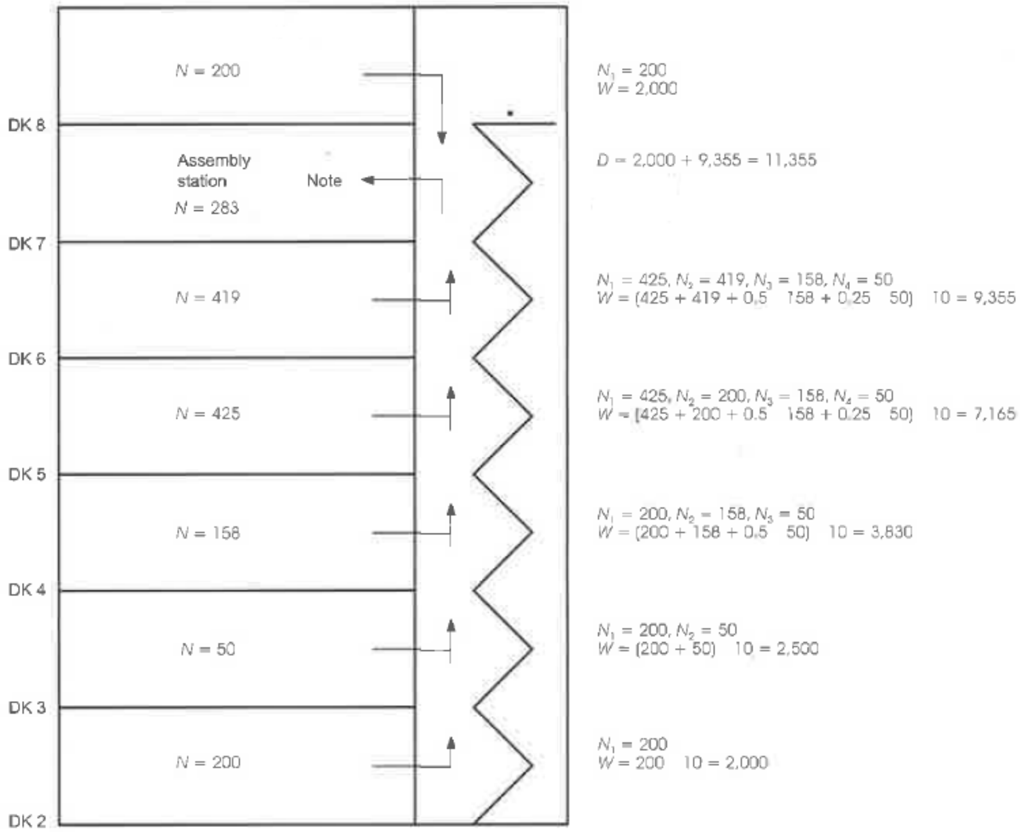
N = $Z - P$ = the number of persons directly entering the stairway flow from a given deck;

Z = number of persons to be evacuated from the deck considered;

S = available landing area (m^2) after subtracting the surface area necessary for movement and subtracting the space taken by the door swing area. Landing area is a sum of flow area, credit area and door area;

D = width of exit doors to the stairway landing area (mm)

Figure 2 - Minimum stairway width (*W*) calculation example



Z (pers) = number of persons expected to evacuate through the stairway
N (pers) = number of persons directly entering the stairway flow from
W (mm) = (N_1 + N_2 + 0.5 x N_3 + 0.25 x N_4) × 10 = calculated width of stairway
D (mm) = width of exit doors
$N_1 > N_2 > N_3 > N_4$ where:
N_1 (pers) = the deck with the largest number of persons N entering directly the stairway
N_2 (pers) = the deck with the next largest number of persons N entering directly the stairway, etc.

Note: The doors to the assembly station shall have aggregate widths of 11,355 mm.

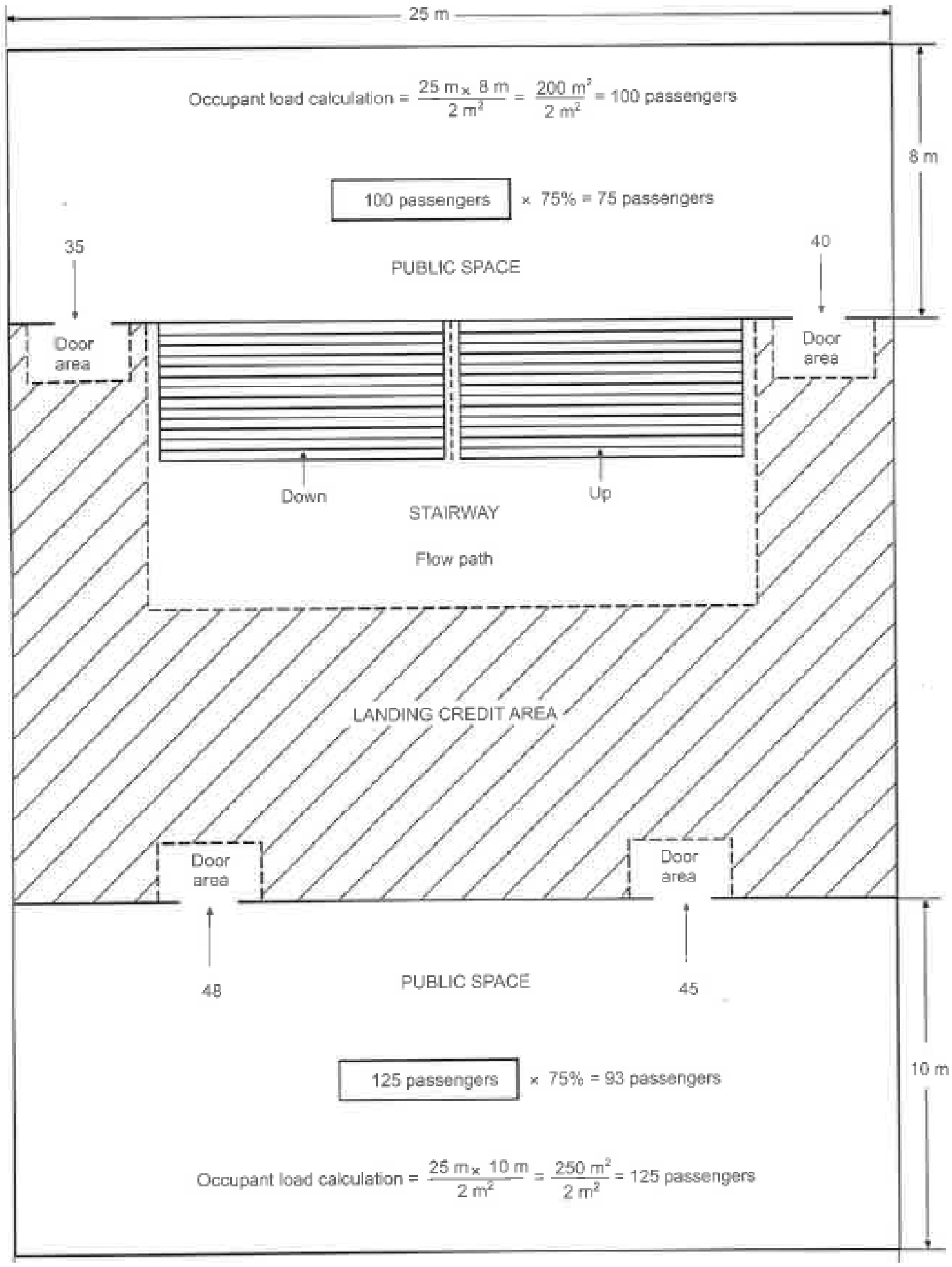
11.1.4.2.2.2.2 Distribution of persons

11.1.4.2.2.2.2.1 The dimension of the means of escape shall be calculated on the basis of the total number of persons expected to escape by the stairway and through doorways, corridors and landings (see figure 3). Calculations shall be made separately for the two cases of occupancy of the spaces specified below. For each component part of the escape route, the dimension taken shall not be less than the largest dimension determined for each case:

Case 1: Passengers in cabins with maximum berthing capacity fully occupied; members of the crew in cabins occupied to 2/3 of maximum berthing capacity; and service spaces occupied by 1/3 of the crew.

Case 2: Passengers in public spaces occupied to 3/4 of maximum capacity, 1/3 of the crew distributed in public spaces; service spaces occupied by 1/3 of the crew; and crew accommodation occupied by 1/3 of the crew.

Figure 3 - Occupant loading calculation example



11.1.4.2.2.2.2.2 The maximum number of persons contained in a vertical zone, including persons entering stairways from another main vertical zone, shall not be assumed to be higher than the maximum number of persons authorized to be carried on board for the calculation of stairway width only. (FSS Code, Ch. 13, par. 2.1.2.2.2.2)

11.1.4.2.3 Prohibition of decrease in width in the direction to the assembly station *

* Refer to the Indication of the "assembly stations" in passenger ships (MSC/Circ.777).

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. (FSS Code, Ch. 13, par. 2,1,3)

11.1.4.3 Details of stairways

11.1.4.3.1 Handrails

Stairways shall be fitted with handrails on each side. The maximum clear width between handrails shall be 1,800 mm. (FSS Code, Ch. 13, par. 2.2.1)

11.1.4.3.2 Alignment of stairways

All stairways sized for more than 90 persons shall be aligned fore and aft. (FSS Code, Ch. 13, par. 2.2.2)

11.1.4.3.3 Vertical rise and inclination

Stairways shall not exceed 3.5 m in vertical rise without the provision of a landing and shall not have an angle of inclination greater than 45 degrees. (FSS Code, Ch. 13, par. 2.2.3)

11.1.4.3.4 Landings

With the exception of intermediate landings, landings at each deck level shall be not less than 2 m^2 in area and shall increase by 1 m^2 for every 10 persons provided for in excess of 20 persons, but need not exceed 16 m^2, except for those landings servicing public spaces having direct access onto the stairway enclosure. Intermediate landings shall be sized in accordance with par. 11.1.4.4.1. (FSS Code par. 2.3.1). (FSS Code, Ch. 13, par. 2.2.4)

IMO interpretation

If landings can be entered directly via entrance doors, situated in stairway enclosures, the area of such landings should comply with the requirements of this paragraph (FSS Code, Ch. 13, par. 2.2.4). However, if landings cannot be entered by entrance doors, such landings should be considered as intermediate landings which should comply with the capacity requirements as given in par. 11.1.4.4.1. (FSS Code, Ch. 13, par. 2.3.1). (MSC/Circ.1120)

11.1.4.4 Doorways and corridors

11.1.4.4.1 Doorways and corridors and intermediate landings included in means of escape shall be sized in the same manner as stairways. (FSS Code, Ch. 13, par. 2.3.1)

This does not apply to cabin doors.

11.1.4.4.2 The aggregate width of stairway exit doors to the assembly station shall not be less than the aggregate width of stairways serving this deck. (FSS Code, Ch. 13, par. 2.3.2)

11.1.4.5 Evacuation routes to the embarkation deck

11.1.4.5.1 Assembly station

It shall be recognized that the evacuation routes to the embarkation deck may include an assembly station. In this case consideration shall be given to the fire-protection requirements and sizing of corridors and doors from the stairway enclosure to the assembly station and from the assembly station to the embarkation deck, noting that evacuation of persons from assembly stations to embarkation positions will be carried out in small control groups. (FSS Code, Ch. 13, par. 2.4.1)

11.1.4.5.2 Routes from the assembly station to the survival craft embarkation position

Where the passengers and crew are held at an assembly station which is not at the survival craft embarkation position, the dimension of stairway width and doors from the assembly station to this position shall be based on the number of persons in the controlled group. The width of these stairways and doors need not exceed 1,500 mm unless larger dimensions are required for evacuation of these spaces under normal conditions. (FSS Code, Ch. 13, par. 2.4.2)

11.1.4.6 Means of escape plans

11.1.4.6.1 Means of escape plans shall be provided indicating the following:

- **.1** the number of the crew and passengers in all normally occupied spaces;
- **.2** the number of crew and passengers expected to escape by stairway and through doorways, corridors and landings;
- **.3** assembly stations and survival craft embarkation positions;
- **.4** primary and secondary means of escape; and
- **.5** width of stairways, doors, corridors and landing areas. (FSS Code, Ch. 13, par. 2.5.1)

11.1.4.6.2 Means of escape plans shall be accompanied by detailed calculation for determining the width of escape stairways, doors, corridors and landing areas. (FSS Code, Ch. 13, par. 2.5.2)

Calculation of means of escape width shall be prepared based on evacuation analysis elaborated in accordance with the guidelines specified in MSC.1/Circ.1533.

11.1.5 Means of escape from control stations, accommodation and service spaces

11.1.5.1 Escape from spaces below the bulkhead deck

11.1.5.1.1 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. Exceptionally, the Administration 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. (SOLAS II-2/13.3.2.1.1)

11.1.5.1.2 Where the Administration has granted dispensation under the provisions of par. 11.1.5.1.1 (SOLAS par. 3.2.1.1), this sole means of escape shall provide safe escape. However, stairways shall not be less than 800 mm in clear width with handrails on both sides. (SOLAS II-2/13.3.2.1.1)

11.1.5.2 Escape from spaces above the bulkhead deck

Above the bulkhead deck there shall be at least two means of escape from each main vertical zone or similarly restricted space or group of spaces at least one of which shall give access to a stairway forming a vertical escape. (SOLAS II-2/13.3.2.2)

11.1.5.3 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 non-hazardous 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 carried can have access, other escape stairways required by par. 11.1.5.4.1 (SOLAS par. 3.2.4.1) and external areas are permitted to have direct access to these stairway enclosures. Public spaces may also have direct access to stairway enclosures except for the backstage 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^2, a width of no less than 900 mm and contain a fire hose station. (SOLAS II-2/13.3.2.3)

11.1.5.4 Details of means of escape

11.1.5.4.1 At least one of the means of escape required by par. 11.1.5.1.1 and 11.1.5.2 (SOLAS par. 3.2.1.1 and 3.2.2) 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 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 in accordance with *Part VIII*, sec. 6.3 (SOLAS reg. III/11.5) 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 9.1 to 9.4, as appropriate. (SOLAS II-2/13.3.2.4.1)

**** IMO interpretation***

The stairway arrangement required by this par. 11.1.5.4.1 (SOLAS reg. II-2/13.3.2.4.1) for below bulkhead deck compartments of one main vertical zone can be arranged by:

- *one enclosed stairway which provides a continuous fire shelter from the level of its origin to the embarkation deck in one watertight compartment;*
- *each of the other compartments have an enclosed stairway which provides a continuous fire shelter from the level of its origin to the bulkhead deck; and*
- *the continuous fire shelter is also provided on the bulkhead deck through a route protected as a category 2 space (horizontal stairway).*

Example of continuous fire shelter of means of escape– see figure for reg 13.3.2.4.1 in the appendix of MSC/Circ.1120.

In applying this interpretation, the content of par. 11.1.5.1.1 (SOLAS reg. 13.3.2.1.1) should also be taken into account. (MSC/Circ.1120)

11.1.5.4.2 Protection of access from the stairway enclosures to the lifeboat and liferaft embarkation areas shall be provided either directly or through protected internal routes which have fire integrity and insulation values for stairway enclosures as determined by tables 9.1 to 9.4, as appropriate. (SOLAS II-2/13.3.2.4.2)

11.1.5.4.3 Stairways serving only a space and a balcony in that space shall not be considered as forming one of the required means of escape. (SOLAS II-2/13.3.2.4.3)

11.1.5.4.4 Each level within an atrium shall have two means of escape, one of which shall give direct access to an enclosed vertical means of escape* meeting the requirements of par. 11.1.5.4.1 (SOLAS par. 3.2.4.1). (SOLAS II-2/13.3.2.4.4)

*** IMO interpretation**

Such enclosed means of escape should be sized taking into account the total number of persons at each level of the atrium considered. *(MSC.1/Circ.1120)*

11.1.5.4.5 The widths, number and continuity of escapes shall be in accordance with the requirements in sec. 11.1.4.2 (FSS Code). (SOLAS II-2/13.3.2.4.5)

11.1.5.5 Marking of escape routes

11.1.5.5.1 In addition to the emergency lighting required by *Part VIII*, sec. 22.1.2 (SOLAS reg. II-1/42 and III/11.5), the means of escape, including stairways and exits, shall be marked by lighting or photoluminescent strip indicators (low location lighting system) placed not more than 300 mm above the deck at all points of the escape route including angles and intersections. The marking 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. Additionally, escape route signs and fire equipment location markings* shall be of photoluminescent material or marked by lighting. The Administration shall ensure that such lighting or photoluminescent equipment has been evaluated, tested and applied in accordance with the sub-chapter 11.1.5.6 (FSS Code). (SOLAS II-2/13.3.2.5.1)

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* Refer to *Escape route signs and equipment location markings* -Res. A.1116 (30).

11.1.5.5.2 In passenger ships carrying more than 36 passengers, the requirements of the par. 11.1.5.5.1 (SOLAS par. 3.2.5.1) shall also apply to the crew accommodation areas. (SOLAS II-2/13.3.2.5.2)

11.1.5.5.3 In lieu of the escape route lighting system required by par. 11.1.5.5.1 (SOLAS par. 3.2.5.1), alternative evacuation guidance systems may be accepted if approved by the Administration based on the guidelines developed by the Organization*. (SOLAS II-2/13.3.2.5.3)

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* Refer to *Functional requirements and performance standards for the assessment of evacuation guidance systems* (MSC/Circ.1167) and *Interim guidelines for the testing, approval and maintenance of evacuation guidance systems used as an alternative to low-location lighting systems* (MSC/Circ.1168).

11.1.5.6 Low location lighting systems

Any required low-location lighting systems shall be approved by the Administration based on the guidelines developed by the Organization,* or to an international standard acceptable to the Organization.** (FSS Code, Ch. 11/2.1.1)

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* Refer to the *Guidelines for the evaluation, testing and application of low-location lighting on passenger ships* as adopted by the Organization by resolution A.752(18).

** Refer to the Recommendations by the International Organization for Standardization, in particular, publication *ISO 15370:2001 on Low- location lighting on passenger ships.*

11.1.5.7 Normally locked doors that form part of an escape route

11.1.5.7.1 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. (SOLAS II-2/13.3.2.6.1)

11.1.5.7.2 Escape doors from public spaces that are normally latched shall be fitted with a means of quick release. Such means shall consist of a door-latching mechanism incorporating a device that releases the latch upon the application of a force in the direction of escape flow. Quick release mechanisms shall be designed and installed to the satisfaction of the Administration and, in particular:

- **.1** consist of bars or panels, the actuating portion of which extends across at least one half of the width of the door leaf, at least 760 mm and not more than 1120 mm above the deck;
- **.2** cause the latch to release when a force not exceeding 67 N is applied; 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. (SOLAS II-2/13.3.2.6.2)

11.1.5.8 Evacuation analysis for passenger ships*

* Refer to the *Revised Guidelines on evacuation analyses for new and existing passenger ships* (MSC.1/Circ.1533), as may be amended.

11.1.5.8.1 Escape routes shall be evaluated by an evacuation analysis early in the design process. This analysis shall apply to:

- **.1** ro-ro passenger ships; and
- **.2** other passenger ships carrying more than 36 passengers. (SOLAS II-2/13.3.2.7.1)

11.1.5.8.2 The analysis shall be used to identify and eliminate, as far as practicable, congestion which may develop during an abandonment, due to normal movement of passengers and crew along escape routes, including the possibility that crew may need to move along these routes in a direction opposite to the movement of passengers. In addition, the analysis shall be used to demonstrate that escape arrangements are sufficiently flexible to provide for the possibility that certain escape routes, assembly stations, embarkation stations or survival craft may not be available as a result of a casualty. (SOLAS II-2/13.3.2.7.2)

11.1.6 Means of escape from machinery spaces

Means of escape from each machinery space in passenger ships shall comply with the following provisions.

11.1.6.1 Escape from spaces below the bulkhead deck

Where the space is below the bulkhead deck the two means of escape shall consist of either:

- .1 two sets of steel ladders[1)] as widely separated as possible, leading to doors in the upper part of the space similarly separated and from which access is provided to the appropriate lifeboat and liferaft embarkation decks. One of these ladders shall be located within a protected enclosure that satisfies sec. 11.1.2.3 (SOLAS reg. 9.2.2.3), category (2), or sec. 11.1.2.4 (SOLAS reg. 9.2.2.4), category (4), as appropriate, from the lower part of the space[2)] it serves to a safe position[3)] outside the space. Self-closing fire doors of the same fire integrity standards shall be fitted in the enclosure. The ladder shall be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The protected enclosure[4)] shall have minimum internal dimensions[5)] of at least 800 mm x 800 mm, and shall have emergency lighting provisions; or

IACS and IMO interpretations

1) *Inclined ladders/stairways in machinery spaces being part of, or providing access to, escape routes, but not located within a protected enclosure shall not have an inclination greater than 60° and shall not be less than 600 mm in clear width. Such requirement need not be applied to ladders/stairways not forming part*

of an escape route, only provided for access to equipment or components, or similar areas, from one of the main platforms or deck levels within such spaces. *(IACS UI SC276, item 2, MSC.1/Circ.1511)*

Ladders having strings of flexible steel wire ropes are not acceptable in such escape routes. *(MSC/Circ.1120)*

2) *Machinery spaces of category A may include working platforms and passageways, or intermediate decks at more than one deck level. In such case, the lower part of the space shall be regarded as the lowest deck level, platform or passageway within the space.*

At deck levels, other than the lowest one, where only one means of escape other than the protected enclosure is provided, self-closing fire doors shall be fitted in the protected

enclosure at that deck level. Smaller working platforms in-between deck levels, or only for access to equipment or components, need not be provided with two means of escape. *(IACS UI SC276, item 3, MSC.1/Circ.1511)*

3) *A "safe position" can be any space, excluding cargo spaces, lockers and storerooms irrespective of their area, cargo pump-rooms and spaces where flammable liquids are stowed, but including vehicle and ro-ro spaces, from which access is provided and maintained clear of obstacles to the open deck.* *(IACS UI SC276, item 1, MSC.1/Circ.1511)*

4) *A protected enclosure providing escape from machinery spaces of category A to an open deck may be fitted with a hatch as means of egress from the enclosure to the open deck. The hatch shall have minimum internal dimensions of 800 mm x 800 mm.* *(IACS UI SC276, item 4, MSC.1/Circ.1511)*

5) *Internal dimensions shall be interpreted as clear width, so that a passage having diameter of 800 mm is available throughout the vertical enclosure, as shown in Figure 1 of MSC.1/Circ.1511, clear of ship's structure, with insulation and equipment, if any. The ladder within the enclosure can be included in the internal dimensions of the enclosure. When protected enclosures include horizontal portions their clear width shall not be less than 600 mm. Figure 7 of MSC.1/Circ.1511 is given as example of some possible arrangements which may be in line with the above interpretation.* *(IACS UI SC276, item 5, MSC.1/Circ.1511)*

.2 one steel ladder leading to a door in the upper part of the space from which access is provided to the embarkation deck and additionally, in the lower part of the space and in a position well separated from the ladder referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the embarkation deck. (SOLAS II-2/13.4.1.1)

11.1.6.2 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. (SOLAS II-2/13.4.1.2)

11.1.6.3 Dispensation from two means of escape

In a ship of less than 1,000 gross tonnage, the Administration may dispense with one of the means of escape, due regard being paid to the width and disposition of the upper part of the space. In a ship of 1,000 gross tonnage and above, the Administration may dispense with one means of escape from any such space, including a normally unattended auxiliary machinery space*, so long as either a door or a steel ladder provides a safe escape route to the embarkation deck, due regard being paid to the nature and location of the space and whether persons are normally employed in that space. In the steering gear space, a second means of escape shall be provided when the emergency steering position is located in that space unless there is direct access to the open deck. (SOLAS II-2/13.4.1.3)

**** IACS interpretation***

The above requirement applies only to auxiliary machinery spaces where persons are not normally employed. *(IACS UI SC41)*

11.1.6.4 Escape from machinery control rooms[1)]

Two means of escape shall be provided from a machinery control room located within a machinery space, at least one of which will provide continuous fire shelter[2)] to a safe position[3)] outside the machinery space. (SOLAS II-2/13.4.1.4)

IMO and IACS interpretations

1) *A "machinery control room" means a space which serves for control and/or monitoring of machinery used for ship's main propulsion. (MSC.1/Circ.1511)*

2) *A "continuous fire shelter" means a route from a main workshop, or from a machinery control room, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by par. 11.1.6.1 or 2.3.3.1.1 (SOLAS reg. II-2/13.4.1.1 or II-2/13.4.2.1.1). The boundaries of the continuous fire shelter shall be at least "A-0" class divisions and be protected by self-closing "A-0" class doors. The continuous fire shelter shall have minimum internal dimensions of at least 800 mm x 800 mm for vertical trunks and 600 mm in width for horizontal trunks, and shall have emergency lighting provisions. The figures below represent typical arrangements of the continuous fire shelters through trunks or through spaces/rooms to a location outside the machinery space, which should be considered as effective. (MSC.1/Circ.1511)*

3) *A "safe position" can be any space, excluding cargo spaces, lockers and storerooms irrespective of their area, cargo pump-rooms and spaces where flammable liquids are stowed, but including vehicle and ro-ro spaces, from which access is provided and maintained clear of obstacles to the open deck. (IACS UI SC276, item 1, MSC.1/Circ.1511)*

11.1.6.5 Inclined ladders and stairways

All inclined ladders/stairways fitted to comply with par. 11.1.6.1 (SOLAS par.4.1.1) with open treads in machinery spaces being part of or providing access to escape routes but not located within a protected enclosure shall be made of steel. Such ladders/stairways shall be fitted with steel shields attached to their undersides, such as to provide escaping personnel protection against heat and flame from beneath. (SOLAS II-2/13.4.1.5)

11.1.6.6 Escape from main workshops within machinery spaces

Two means of escape shall be provided from the main workshop[1)] within a machinery space. At least one of these escape routes shall provide a continuous fire shelter[2)] to a safe position outside the machinery space. (SOLAS II-2/13.4.1.6)

IMO interpretations

1) *A "main workshop" means a compartment enclosed on at least three sides by bulkheads or gratings, usually containing welding equipment, metal working machinery and workbenches. (MSC.1/Circ.1511)*

2) *A "continuous fire shelter" means a route from a main workshop, or from a machinery control room, which allows safe escape, without entering the machinery space, to a location outside the machinery space. Such a continuous fire shelter need not be a protected enclosure as envisaged by par. 11.1.6.1 or 2.3.3.1.1 (SOLAS reg. II-2/13.4.1.1 or II-2/13.4.2.1.1). The boundaries of the continuous fire shelter shall be at least "A-0" class divisions and be protected by self-closing "A-0" class doors. The continuous fire shelter shall have minimum internal dimensions of at least 800 mm x 800 mm for vertical trunks and 600 mm in width for horizontal trunks, and shall have emergency lighting provisions. The figures below represent typical arrangements of the continuous fire shelters through trunks or through spaces/rooms to a location outside the machinery space, which should be considered as effective. (MSC.1/Circ.1511)*

11.1.6.7 Means of escape on passenger ships from special category and open ro-ro spaces to which any passengers carried can have access

11.1.6.7.1 In special category and open ro-ro spaces to which any passengers carried can have access, the number and locations of the means of escape both below and above the bulkhead deck shall be to the satisfaction of the Administration and, in general, the safety of access to the embarkation deck shall be at least equivalent to that provided for under par. 11.1.5.11, 11.1.5.2, 11.1.5.4.1 and 11.1.5.4.2 (SOLAS par. 3.2.1.1, 3.2.2, 3.2.4.1 and 3.2.4.2). Such spaces shall be provided with designated longitudinal walkways leading to the means of escape (exit doors) with a breadth of at least 600 mm, clearly painted on the space floor. The parking arrangements for the vehicles shall maintain the walkways clear at all times. (SOLAS II-2/13.5.1)

11.1.6.7.2 One of the escape routes from the machinery spaces where the crew is normally employed shall avoid direct access to any special category space. (SOLAS II-2/13.5.2)

11.1.6.8 Additional requirements for ro-ro passenger ships

11.1.6.8.1 General

11.1.6.8.1.1 Escape routes shall be provided from every normally occupied space on the ship to an assembly station. These escape routes shall be arranged so as to provide the most direct route possible to the assembly station*, and shall be marked with symbols based on the guidelines developed by the Organization.** (SOLAS II-2/13.7.1.1)

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* Refer to Indication of the "assembly stations" in passenger ships (MSC/Circ.777)

** Refer to *Symbols related to life-saving appliances and arrangements* (resolution A.760(18), as amended) and/or tables 1 and 2 of *Escape route signs and equipment location markings* (resolution A.1116(30)), as appropriate. Refer to the new symbols in tables 1 and 2 of resolution A.1116(30) where the symbols for a specific item are differently expressed in resolutions A.760(18), as amended and A.1116(30).

11.1.6.8.1.2 The escape route from cabins to stairway enclosures shall be as direct as possible, with a minimum number of changes in direction. It shall not be necessary to cross from one side of the ship to the other to reach an escape route. It shall not be necessary to climb more than two decks up or down in order to reach an assembly station or open deck from any passenger space. (SOLAS II-2/13.7.1.2)

11.1.6.8.1.3 External routes shall be provided from open decks, as referred to in par. 11.1.6.8.1.2 (SOLAS par. 7.1.2), to the survival craft embarkation stations. (SOLAS II-2/13.7.1.3)

11.1.6.8.1.4 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. (SOLAS II-2/13.7.1.4)

11.1.6.8.1.5 Escape routes shall not be obstructed by furniture and other obstructions. With the exception of tables and chairs which may be cleared to provide open space, cabinets and other heavy furnishings in public spaces and along escape routes shall be secured in place to prevent shifting if the ship rolls or lists. Floor coverings shall also be secured in place. When the ship is underway, escape routes shall be kept clear of obstructions such as cleaning carts, bedding, luggage and boxes of goods. (SOLAS II-2/13.7.1.5)

11.1.6.8.2 Instruction for safe escape

11.1.6.8.2.1 Decks shall be sequentially numbered, starting with "1" at the tank top or lowest deck. The numbers shall be prominently displayed at stair landings and lift lobbies. Decks may also be named, but the deck number shall always be displayed with the name. (SOLAS II-2/13.7.2.1)

11.1.6.8.2.2 Simple "mimic" plans showing the "you are here" position and escape routes marked by arrows, shall be prominently displayed on the inside of each cabin door and in public spaces. The plan shall show the directions of escape and shall be properly oriented in relation to its position on the ship. (SOLAS II-2/13.7.2.2)

11.1.6.8.3 Strength of handrails and corridors

11.1.6.8.3.1 Handrails or other handholds shall be provided in corridors along the entire escape route so that a firm handhold is available at every step of the way, where possible, to the assembly stations and embarkation stations. Such handrails shall be provided on both sides of longitudinal corridors more than 1.8 m in width and transverse corridors more than 1 m in width. Particular attention shall be paid to the need to be able to cross lobbies, atriums and other large open spaces along escape routes. Handrails and other handholds shall be of such strength as to withstand a distributed horizontal load of 750 N/m applied in the direction of the centre of the corridor or space, and a distributed vertical load of 750 N/m applied in the downward direction. The two loads need not be applied simultaneously. (SOLAS II-2/13.7.3.1)

11.1.6.8.3.2 The lowest 0.5 m of bulkheads and other partitions forming vertical divisions along escape routes shall be able to sustain a load of 750 N/m to allow them to be used as walking surfaces from the side of the escape route with the ship at large angles of heel. (SOLAS II-2/13.7.3.2)

11.1.7 Emergency escape breathing devices (EEBD)

11.1.7.1 Emergency escape breathing devices shall comply with sec. 5.5 (FSS Code). Spare emergency escape breathing devices shall be kept onboard. (SOLAS II-2/13.3.4.1)

11.1.7.2 All ships shall carry at least two emergency escape breathing devices within accommodation spaces. (SOLAS II-2/13.3.4.2)

11.1.7.3 In passenger ships, at least two emergency escape breathing devices shall be carried in each main vertical zone*. (SOLAS II-2/13.3.4.3)

**** IMO interpretation***

The minimum number of EEBDs to be kept within accommodation spaces should be as follows:

- *for passenger ships carrying not more than 36 passengers: two (2) EEBDs for each main vertical zone, except those defined in par. 11.1.7.5 (SOLAS reg. 13.3.4.5), and a total of two (2) spare EEBDs. (MSC/Circ.1081)*

11.1.7.4 In passenger ships carrying more than 36 passengers, two emergency escape breathing devices, in addition to those required in par. 11.1.7.3 (SOLAS par. 3.4.3) above, shall be carried in each main vertical zone*. (SOLAS II-2/13.3.4.4)

**** IMO interpretation***

The minimum number of EEBDs to be kept within accommodation spaces should be as follows:

- *for passenger ships carrying more than 36 passengers: four (4) EEBDs for each main vertical zone, except those defined in par. 11.1.7.5 (SOLAS reg. 13.3.4.5), and a total of two (2) spare EEBDs. (MSC/Circ.1081)*

11.1.7.5 However, par 11.1.7.3 and 11.1.7.4 (SOLAS par. 3.4.3 and 3.4.4) do not apply to stairway enclosures which constitute individual main vertical zones and for the main vertical zones in the fore or aft end of a ship which do not contain spaces of categories (6), (7), (8) or (12) defined in par.11.1.2.3 (SOLAS reg. 9.2.2.3). (SOLAS II-2/13.3.4.5)

11.1.8 Automatic sprinkler systems in control stations, accommodation and service spaces

11.1.8.1 Requirements for the system

Automatic sprinkler system is to comply with the requirements specified in sub-chapter 3.3 and additionally with the requirements of this sec. 11.1.8.

11.1.8.1.1 Sources of power supply

There shall be not less than two sources of power supply for the sea water pump and automatic alarm and detection system. Where the sources of power for the pump are electrical, these shall be a main generator and an emergency source of power. One supply for the pump shall be taken from the main switchboard, and one from the emergency switchboard by separate feeders reserved solely for that purpose. The feeders shall be so arranged as to avoid galleys, machinery spaces and other enclosed spaces of high fire risk except in so far as it is necessary to reach the appropriate switchboards, and shall be run to an automatic changeover switch situated near the sprinkler pump. This switch shall permit the supply of power from the main switchboard so long as a supply is available therefrom, and be so designed that upon failure of that supply it will automatically change over to the supply from the emergency switchboard. The switches on the main switchboard and the emergency switchboard shall be clearly labelled and normally kept closed. No other switch shall be permitted in the feeders concerned. One of the sources of power supply for the alarm and detection system shall be an emergency source. Where one of the sources of power for the pump is an internal combustion engine it shall, in addition to complying with the provisions of par. 3.3.5.3 (FSS Code, par. 2.4.3), be so situated that a fire in any protected space will not affect the air supply to the machinery. (FSS Code, Ch. 8/2.2.1)

11.1.8.1.2 Piping arrangements

Sprinklers shall be grouped into separate sections, each of which shall contain not more than 200 sprinklers. In passenger ships any section of sprinklers shall not serve more than two decks and shall not be situated in more than one main vertical zone. However, the Administration may permit such a section of sprinklers to serve more than two decks or be situated in more than one main vertical zone, if it is satisfied that the protection of the ship against fire will not thereby be reduced. (FSS Code, Ch. 8/2.4.2.1)

11.1.8.1.3 Alarm and indication

The indicating unit of the automatic sprinkler system with alarm signalization shall be located in the continuously manned central control station or onboard safety centre, if provided.

11.1.8.2 Arrangements of the system on passenger ships

11.1.8.2.1 Passenger ships carrying more than 36 passengers shall be equipped with an automatic sprinkler, fire detection and fire alarm system of an approved type complying with the requirements of sub-chapter 3.3 (FSS Code) in all control stations, accommodation and service 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. 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. (SOLAS II-2/10.6.1.1)

11.1.8.2.2 In passenger ships carrying not more than 36 passengers, when a fixed smoke detection and fire alarm system complying with the provisions of sub-chapter 4.1 (FSS Code) is provided only in corridors, stairways and escape routes within accommodation spaces, an automatic sprinkler system shall be installed in accordance with par. 4.9.4.1.2 (SOLAS reg. 7.5.3.2). (SOLAS II-2/10.6.1.2)

11.1.9 Fire detection and fire alarm systems in control stations, accommodation and service spaces

11.1.9.1 General requirements

A fixed fire detection and fire alarm system is to comply with the requirements specified in sub-chapter 4.1 and additionally with the requirements of this sec. 11.1.9.

11.1.9.1.1 A fixed fire detection and fire alarm system for passenger ships shall be capable of remotely and individually identifying each detector and manually operated call point. (SOLAS II-2/7.2.4, FSS Code/2.1.7)

11.1.9.1.2 Fire detectors fitted in passenger ship cabins, when activated, shall also be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located. (FSS Code, Ch. 9/2.1.7)

11.1.9.1.3 On passenger ships, cables used in the electrical circuits shall be flame retardant according to standard IEC 60332-1. On passenger ships, cables routed through other main vertical zones that they serve, and cables to control panels in an unattended fire control station shall be fire resisting according to standard IEC 60331, unless duplicated and well separated. (FSS Code, Ch. 9/2.3.3)

11.1.9.1.4 In passenger ships, a section of detectors and manually operated call points shall not be situated in more than one main vertical zone, except on cabin balconies. (FSS Code, Ch. 9/2.4.1.4)

11.1.9.1.5 In passenger ships, the control panel shall be located in the onboard safety centre. (FSS Code, Ch. 9/2.5.1.2)

11.1.9.1.6 In passenger ships, an 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. (FSS Code, Ch. 9/2.5.1.3)

11.1.9.2 Smoke detectors in accommodation spaces

Smoke detectors shall be installed in all stairways, corridors and escape routes within accommodation spaces as provided in par. 11.1.9.3, 11.1.9.4 and 11.1.11.1 (SOLAS par. 5.2, 5.3 and 5.4). Consideration shall be given to the installation of special purpose smoke detectors within ventilation ducting. (SOLAS II-2/7.5.1)

11.1.9.3 Requirements for passenger ships carrying more than 36 passengers

A fixed fire detection and fire alarm system, complying with requirements of this sec. 11.1.9, shall be installed and arranged as to provide smoke detection* in service spaces, control stations and accommodation spaces, including corridors, stairways and escape routes within accommodation spaces. Smoke detectors need not be fitted in private bathrooms and galleys. Spaces having little or no fire risk such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with a fixed fire detection and alarm system. Detectors fitted in cabins, when activated, shall also be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located. (SOLAS II-2/7.5.2)

**** IACS interpretation***

Heat detectors are acceptable in refrigerated chambers and in other spaces where steam and fumes are produced such as saunas and laundries. Refrigerated chambers may be fitted with dry pipe sprinkler systems. (IACS UI SC130)

11.1.9.4 Requirements for passenger ships carrying not more than 36 passengers

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

.1 a fixed fire detection and fire alarm system, complying with requirements of this sec. 11.1.9, so installed and arranged as to detect the presence of fire in such spaces and providing smoke detection in corridors, stairways and escape routes within accommodation spaces. Detectors fitted in cabins, when activated, shall also be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located; or

.2 an automatic sprinkler, fire detection and fire alarm system of an approved type complying with the relevant requirements of sec. 11.1.8 (FSS Code) and so installed and arranged as to protect such spaces and, in addition, a fixed fire detection and fire alarm system and so installed and arranged as to provide smoke detection in corridors, stairways and escape routes within accommodation spaces. (SOLAS II-2/7.5.3)

11.1.9.5 Fire patrols in passenger ships

For ships carrying more than 36 passengers an efficient patrol system shall be maintained so that an outbreak of fire may be promptly detected. Each member of the fire patrol shall be trained to be familiar with the arrangements of the ship as well as the location and operation of any equipment he may be called upon to use. (SOLAS II-2/7.8.1)

11.1.9.6 Two-way portable radiotelephone apparatus

Each member of the fire patrol shall be provided with a two-way portable radiotelephone apparatus*. (SOLAS II-2/7.8.3)

***** ***IMO interpretation***

On ships provided with special category spaces, ro-ro spaces or cargo spaces for the carriage of dangerous goods, the two-way portable telephone apparatus should be of certified safe type for use in zone 1 areas as defined in IEC Publication 60079 - Electrical Apparatus for Explosive Gas Atmospheres.

Two-way portable telephone apparatus should be audible from most parts of the ship. As a minimum, they should be audible where the fire patrol makes their rounds such as key box locations and the routes specified on the fire patrol checklist. If necessary, extra antennae should be fitted to obtain effective communication. (MSC/Circ.1120)

11.1.9.7 Fire alarm signaling systems in passenger ships*

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* Refer to the *Code on alerts and indicators 2009* (resolution A.1021(26)), as may be amended).

11.1.9.7.1 The control panel of fixed fire detection and fire alarm systems shall be designed on the fail-safe principle (e.g. an open detector circuit shall cause an alarm condition). (SOLAS II-2/7.9.2)

11.1.9.7.2 Passenger ships carrying more than 36 passengers shall have the fire detection alarms for the systems required by par. 11.1.9.3 (SOLAS par. 5.2) centralized in a continuously manned central control station. In addition, controls for remote closing of the fire doors and shutting down the ventilation fans* shall be centralized in the same location. The ventilation fans shall be capable of reactivation by the crew at the continuously manned control station. The control panels in the central control station shall be capable of indicating open or closed positions of fire doors and closed or off status of the detectors, alarms and fans. The control panel shall be continuously powered and shall have an automatic change-over to standby power supply in case of loss of normal power supply. The control panel shall be powered from the main source of electrical power and the emergency source of electrical power defined by SOLAS reg. II-1/42 unless other arrangements are permitted by the regulations, as applicable. (SOLAS II-2/7.9.3)

*** IACS interpretation**

The fan in a HVAC temperature control unit, or a circulation fan inside a cabinet/switchboard, is not considered to be a ventilation fan as addressed in this par. (SOLAS Reg.II-2/5.2.1.2, Reg.II-2/5.2.1.3 and Reg.II-2/7.9.3), if it is not capable of supplying outside air to the space when the power ventilation is shut down (e.g., small units intended for re-circulation of air within a cabin).

Therefore, such fans need not be capable of being stopped from an easily accessible position (or a safe position) outside the space being served when applying SOLAS Reg.II-2/5.2.1.2 or Reg.II-2/5.2.1.3, and need not be capable of being controlled from a continuously manned central control station for passenger ships carrying more than 36 passengers when applying this par. (SOLAS Reg.II-2/7.9.3). (IACS UI SC148)

11.1.9.7.3 A special alarm, operated from the navigation bridge or fire control station, shall be fitted to summon the crew. This alarm may be part of the ship' s general alarm system and shall be capable of being sounded independently of the alarm to the passenger spaces. (SOLAS II-2/7.9.4)

11.1.10 Protection of cabin balconies on passenger ships

11.1.10.1 A fixed fire detection and fire alarm system complying with the provisions of sub-chapter 4.1 (FSS Code) shall be installed on cabin balconies of ships to which par. 11.1.1.6 (SOLAS reg. 5.3.4) applies, when furniture and furnishings on such balconies are not as defined in par.1.2.40.1, 1.2.40.2, 1.2.40.3, 1.2.40.6 and 1.2.40.7 (SOLAS reg. 3.40.1, 3.40.2, 3.40.3, 3.40.6 and 3.40.7). (SOLAS II-2/7.10)

11.1.10.2 On passenger ship cabin balconies the fixed fire detection and fire alarm system shall, as a minimum, have section identification capability. (FSS Code, Ch. 9/2.1.7)

11.1.10.3 Fixed fire detection and fire alarm systems for cabin balconies shall be approved by the Administration, based on the guidelines developed by the Organization*. (FSS Code, Ch. 9/2.3.1.7)

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* Refer to the *Guidelines for approval of fixed fire detection and fire alarm systems for cabin balconies* (MSC.1/Circ.1242).

11.1.10.4 A fixed pressure water-spraying fire-extinguishing system complying with the provisions of sec. 3.4.7 (FSS Code) shall be installed on cabin balconies of ships to which par. 11.1.1.6 (SOLAS reg. 5.3.4) applies, where furniture and furnishings on such balconies are not as defined in par.1.2.40.1, 1.2.40.2, 1.2.40.3, 1.2.40.6 and 1.2.40.7 (SOLAS reg. 3.40.1, 3.40.2, 3.40.3, 3.40.6 and 3.40.7). (SOLAS II-2/10.6.1.3)

11.1.10.5 On passenger ship cabin balconies, where an individually identifiable system is fitted, notwithstanding the provisions in par. 4.1.3.9.1 (FSS Code, paragraph 2.1.6.1), isolator modules need not be provided at each fire detector if the system is arranged in such a way that the number and location of individually identifiable fire detectors rendered ineffective due to a fault would not be larger than an equivalent section in a section identifiable system, arranged in accordance with par. 4.1.6.1 (FSS Code, paragraph 2.4.1). (FSS Code, Ch. 9/2.1.8)

11.1.11 Protection of atriums in passenger ships

11.1.11.1 The entire main vertical zone containing the atrium shall be protected throughout with a smoke detection system. (SOLAS II-2/7.5.4)

11.1.11.2 Atriums shall be equipped with a smoke extraction system*. The smoke extraction system shall be activated by the required smoke detection system and be capable of manual control. The fans shall be sized such that the entire volume within space can be exhausted in 10 min or less. (SOLAS II-2/8.5)

**** IMO interpretation***

The application of this regulation does not imply the arrangement of additional exhaust fans other than those normally dedicated to the space considered, if these latter fans are of sufficient size to meet the required capacity. (MSC/Circ.1120)

See MSC/Circ.1034 - *Guidelines smoke control and ventilation systems for internal assembly stations and atriums on new passenger ships.*

11.1.12 Protection of cargo spaces in passenger ships

11.1.12.1 Except as provided for ships engaged in carriage of dangerous goods (SOLAS par. 7.2), the cargo spaces of passenger ships of 1,000 gross tonnage and upwards shall be protected by a fixed carbon dioxide or inert gas fire-extinguishing system complying with the provisions of sub-chapter 3.6 (FSS Code) or by a fixed high expansion foam fire-extinguishing system which gives equivalent protection. (SOLAS II-2/10.7.1.1)

11.1.12.2 Where it is shown to the satisfaction of the Administration that a passenger ship is engaged on voyages of such short duration that it would be unreasonable to apply the requirements of par. 11.1.12.1 (SOLAS par. 7.1.1) and also in ships of less than 1,000 gross tonnage, the arrangements in cargo spaces shall be to the satisfaction of the Administration, 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. (SOLAS II-2/10.7.1.2)

11.1.12.3 A fixed fire detection and fire alarm system or a sample extraction smoke detection system shall be provided in any cargo space which, in the opinion of the Administration, is not accessible, except where it is shown to the satisfaction of the Administration that the ship is engaged on voyages of such short duration that it would be unreasonable to apply this requirement. (SOLAS II-2/7.6)

11.1.13 Water fire main system

11.1.13.1 General

Water fire main system is to comply with the applicable requirements specified in sub-chapter 3.2 and additionally with the requirements of this sec. 11.1.13.

11.1.13.2 Ready availability of water supply

The arrangements for the ready availability of water supply shall be:

.1 in passenger ships:

.1.1 of 1,000 gross tonnage and upwards 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 one required fire pump;

It means that the water fire main system shall be constantly under pressure and when the pressure drops after opening the hydrant, the pressure switch shall start the fire pump.

.1.2 of less than 1,000 gross tonnage by automatic start of at least one fire pump or by remote starting from the navigation bridge of at least one fire pump. If the pump starts automatically or if the bottom valve cannot be opened from where the pump is remotely started, the bottom valve shall always be kept open; and

.1.3 if fitted with periodically unattended machinery spaces in accordance with sub-chapter 12.5.3.1 (SOLAS reg. II-1/54). (SOLAS II-2/10.2.1.2)

11.1.13.3 Number and position of hydrants

In addition to the requirements in sub-chapter 3.2.1.4.1 (SOLAS par. 2.1.5.1), passenger ships shall comply with the following:

.1 in the accommodation, service and machinery spaces the number and position of hydrants shall be such that the requirements of sub-chapter 3.2.1.4.1 (SOLAS par. 2.1.5.1) may be complied with when all watertight doors and all doors in main vertical zone bulkheads are closed; and

.2 where access is provided to a machinery space of category A at a low level from an adjacent shaft tunnel, two hydrants shall be provided external to, but near the entrance to that machinery space. Where such access is provided from other spaces, in one of those spaces two hydrants shall be provided near the entrance to the machinery space of category A. Such provision need not be made where the tunnel or adjacent spaces are not part of the escape route. (SOLAS II-2/10.2.1.5.2)

11.1.13.4 Pressure at hydrants

With the two pumps simultaneously delivering water through the nozzles specified in sec. 3.2.4.3 (SOLAS par. 2.3.3), with the quantity of water as specified in sec. 3.2.1.2 (SOLAS par. 2.1.3), through any adjacent hydrants, the following minimum pressures shall be maintained at all hydrants:

.1 for passenger ships:

- 4,000 gross tonnage and upwards 0.40 N/mm²
- less than 4,000 gross tonnage 0.30 N/mm² (SOLAS II-2/10.2.1.6)

11.1.13.5 Number of fire pumps

Ships shall be provided with independently driven fire pumps as follows:

.1 in passenger ships of:

- 4,000 gross tonnage and upwards at least three
- less than 4,000 gross tonnage at least two. (SOLAS II-2/10.2.2.2.1)

11.1.13.6 Arrangement of fire pumps and fire mains

The arrangement of sea connections, fire pumps and their sources of power shall be as to ensure that:

.1 in passenger ships of 1,000 gross tonnage and upwards, in the event of a fire in any one compartment all the fire pumps will not be put out of action;

.2 in passenger ships of less than 1,000 gross tonnage, if a fire in any one compartment could put all the pumps out of action, there shall be an alternative means consisting of an emergency fire pump* complying with the requirements of sec. 3.2.2.4 (FSS Code) with its source of power and sea connection located outside the space where the main fire pumps or their sources of power are located. (SOLAS II-2/10.2.2.3.1)

**** IACS interpretation***

Unless the two main fire pumps, their sea suctions and the fuel supply or source of power for each pump are situated within compartments separated at least by "A-O" divisions, so that a fire in any one compartment will not render both fire pumps inoperable, an emergency fire pump should be fitted.

An arrangement in which one main fire pump is located in 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. (IACS UI SC162)

11.1.13.7 Total capacity of required fire pumps

The required fire pumps shall be capable of delivering for fire-fighting purposes a quantity of water, at the pressure specified in par. 11.1.13.4 (SOLAS par. 2.1.6), as follows:

.1 pumps in passenger ships, the quantity of water is not less than two thirds of the quantity required to be dealt with by the bilge pumps when employed for bilge pumping. (SOLAS II-2/10.2.2.4.1)

The required bilge pump capacity shall be determined in accordance with requirements specified in *Part VI*, sec. 17.1.3.

11.1.13.8 Capacity of the emergency fire pump

The capacity of the pump shall not be less than 40% of the total capacity of the fire pumps required by par. 11.1.13.7 (SOLAS reg. II-2/10.2.2.4.1) and in any case not less than the follow:

.1 for passenger ships less than 1,000 gross tonnage (...) – 25 m^3/h.

(FSS Code, Ch. 12/2.2.1.1.1)

11.1.13.9 Fire hoses and nozzles

Additionally, in interior locations in passenger ships carrying more than 36 passengers fire hoses shall be connected to the hydrants at all times. (SOLAS II-2/10.2.3.1.1)

11.1.13.10 Number and diameter of fire hoses

In passenger ships, there shall be at least one fire hose for each of the hydrants required by par. 11.1.13.3 (SOLAS par. 2.1.5) and these hoses shall be used only for the purposes of extinguishing fires or testing the fire-extinguishing apparatus at fire drills and surveys. (SOLAS II-2/10.2.3.2.2)

11.1.14 Protection of machinery spaces

11.1.14.1 In all passenger ships, machinery spaces of category A shall be provided with a fixed fire-extinguishing system, as specified in par. 6.2.1.1.1.

11.1.14.2 Additionally to sec. 6.2.7, in passenger ships of 500 gross tonnage and above (...), machinery spaces of category A above 500 m^3 in volume shall, in addition to the fixed fire-extinguishing system required in par.11.1.14.1 (SOLAS par. 5.1.1), be protected by an approved type of fixed water-based or equivalent local application fire-fighting system, complying with requirements of sec. 3.4.4. (SOLAS II-2/10.5.6.1 and .2)

11.1.14.3 In passenger ships carrying more than 36 passengers, each machinery space of category A shall be provided with at least two suitable water fog applicators. (SOLAS II-2/10.5.5)

A water fog applicator might consist of a metal L-shaped pipe, the long limb being about 2 m in length capable of being fitted to a fire hose and the short limb being about 250 mm in length fitted with a fixed water fog nozzle or capable of being fitted with a water spray nozzle .

11.1.15 Fire-fighter' s outfits

11.1.15.1 In addition to requirements specified in par. 6.7.2.1, in passenger ships the number of fire-fighter's outfits there shall be set as follows:

.1 for every 80 m, or part thereof, of the aggregate of the lengths of all passenger spaces and service spaces on the deck which carries such spaces 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, in addition, two sets of personal equipment, each set comprising the items stipulated in sub-chapter 5.4 (FSS Code). 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 sec.11.1.2.3 (SOLAS reg. 9.2.2.3), no additional fire-fighter's outfits are required; and

.2 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. (SOLAS II-2/10.10.2.2)

11.1.15.2 Two spare charges shall be provided for each required breathing apparatus. Passenger ships carrying not more than 36 passengers (…) that are equipped with suitably located means for fully recharging the air cylinders free from contamination, need carry only one spare charge for each required apparatus. In passenger ships carrying more than 36 passengers, at least two spare charges for each breathing apparatus shall be provided. (SOLAS II-2/10.10.2.5)

11.1.15.3 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 1,200 *l* per required breathing apparatus, not to exceed 50,000 *l* of free air. (SOLAS II-2/10.10.2.6)

11.1.15.4 In 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. (SOLAS II-2/10.10.3.2)

11.1.16 Additional requirements for large passenger ships in the context of safe return to port – additional mark: SRP

Fire protection of passenger ships having length, as defined in regulation II-1/2.5, of 120 m or more or having three or more main vertical zones, shall comply with the applicable requirements of *Publication 90/P*.

11.1.17 Safety centre on passenger ships

11.1.17.1 Application

Passenger ships shall have on board a safety centre complying with the requirements of this sec. 11.1.17 (regulation). (SOLAS II-2/23.1)

11.1.17.2 Purpose

The purpose of this sec. 11.1.17 (regulation) is to provide a space to assist with the management of emergency situations. (SOLAS II-2/23.2)

11.1.17.3 Location and arrangement

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. (SOLAS II-2/23.3)

11.1.17.4 Layout and ergonomic design

The layout and ergonomic design of the safety centre shall take into account the guidelines developed by the Organization*, as appropriate. (SOLAS II-2/23.4)

*** IMO interpretation**

See Interim clarifications of SOLAS chapter II-2 requirements regarding interrelation between the central control station, navigation bridge and safety centre. (MSC.1/Circ.1368)

11.1.17.5 Communications

Means of communication between the safety centre, the central control station, the navigation bridge, the engine control room, the storage room(s) for fire extinguishing system(s) and fire equipment lockers shall be provided. (SOLAS II-2/23.5)

11.1.17.6 Control and monitoring of safety systems

Notwithstanding the requirements set out elsewhere in this *Part V* (the Convention), the full functionality (operation, control, monitoring or any combination thereof, as required) of the safety systems listed below shall be available from the safety centre:

.1 all powered ventilation systems;
.2 fire doors;
.3 general emergency alarm system;
.4 public address system;
.5 electrically powered evacuation guidance systems;
.6 watertight and semi-watertight doors;
.7 indicators for shell doors, loading doors and other closing appliances;
.8 water leakage of inner/outer bow doors, stern doors and any other shell door;
.9 television surveillance system;
.10 fire detection and alarm system;
.11 fixed fire-fighting local application system(s);
.12 sprinkler and equivalent systems;
.13 water-based systems for machinery spaces;
.14 alarm to summon the crew;
.15 atrium smoke extraction system;
.16 flooding detection systems; and
.17 fire pumps and emergency fire pumps. (SOLAS II-2/23.6)

11.1.18 Fixed gas fire-extinguishing systems for dangerous goods

See requirements specified in sec. 6.5.2. (SOLAS II-2/10.7.2)

11.1.19 Fire Control Plans

11.1.19.1 The *Fire Control Plan* is required for each passenger ship, regardless of its gross tonnage.

11.1.19.2 In ships carrying more than 36 passengers, plans and booklets required by this sub-chapter 11.1 (regulation) shall provide information regarding fire protection, fire detection and fire extinction based on the guidelines issued by the Organization.* (SOLAS II-2/15.3.2)

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* Refer to *Guidelines on the information to be provided with fire control plans and booklets required by SOLAS reg. II-2/20 and 41-2* (Res. A.756(18)).

11.1.20 Additional requirements for ro-ro passenger ships – additional mark: RO-RO/PASSENGER SHIPS

11.1.20.1 Fire protection of vehicle, ro-ro spaces and special category spaces

11.1.20.1.1 Application

In addition to complying with the requirements of this *Part V* (SOLAS reg. in parts B, C, D and E), as appropriate, vehicle, special category and ro-ro spaces shall comply with the requirements of this section. (SOLAS II-2/20.2.1.1)

11.1.20.1.2 Basic principles for passenger ships

11.1.20.1.2.1 The basic principle underlying the provisions of this sec. 11.1.20 (regulation) is that the main vertical zoning required by sec. 11.1.2 (SOLAS reg. II-2/9.2) may not be practicable in vehicle spaces of passenger ships and, therefore, equivalent protection must be obtained in such spaces on the basis of a horizontal zone concept and by the provision of an efficient fixed fire-extinguishing system. Based on this concept, a horizontal zone for the purpose of this sec. 11.1.20 (regulation) may include special category spaces on more than one deck provided that the total overall clear height* for vehicles does not exceed 10 m. (SOLAS II-2/20.2.2.1)

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* ***IACS and IMO interpretation***

The "total overall clear height" is the sum of distances between deck and web frames of the decks forming one horizontal zone. (IACS UI SC158, MSC/Circ.1120)

11.1.20.1.2.2 The basic principle underlying the provisions of par. 11.1.20.1.2.1 (SOLAS II-2/20.2.2.1) are also applicable to ro-ro spaces. (SOLAS II-2/20.2.2.2)

11.1.20.1.2.3 The requirements of ventilation systems, openings in "A" class divisions and penetrations in "A" class divisions for maintaining the integrity of vertical zones in this *Part V* (chapter) shall be applied equally to decks and bulkheads forming the boundaries separating horizontal zones from each other and from the remainder of the ship. (SOLAS II-2/20.2.2.3)

11.1.20.2 Precaution against ignition of flammable vapours in closed vehicle spaces and closed ro-ro spaces and special category spaces

11.1.20.2.1 Ventilation systems

See sec. 17.3.3 of *Part VI*.

11.1.20.2.1.1 Permanent openings

In special category spaces and ro-ro spaces, the design of permanent openings in the side plating, the ends or deckhead of the space, is prohibited.

11.1.20.2.1.2 Location of ventilation inlet or outlet

See requirements of par. 11.3.1.2.1.6.

11.1.20.2.2 Electrical equipment and wiring

See requirements of par. 11.3.1.2.2. (SOLAS II-2/20.3.2)

11.1.20.2.3 Electrical equipment and wiring in exhaust ventilation ducts

See requirements of par. 11.3.1.2.3. (SOLAS II-2/20.3.3)

11.1.20.2.4 Other ignition sources

See requirements of par. 11.3.1.2.4. (SOLAS II-2/20.3.4)

11.1.20.2.5 Scuppers and discharges

See requirements of par. 11.3.1.2.5. (SOLAS II-2/20.3.5)

11.1.20.2.6 Electrical connections on ro-ro decks serving reefer unit

See requirements of par. 11.3.1.2.6.

11.1.20.3 Detection and alarm*

*** IACS interpretation**

The requirements for a fixed fire extinguishing system, fire detection, foam applicators and portable extinguishers need not apply to weather decks used for the carriage of vehicle with fuel in their tanks. (IACS UI SC73)

11.1.20.3.1 Fixed fire detection and fire alarm systems

Ro-ro and special category spaces shall be provided with an addressable fixed fire detection and fire alarm system complying with the requirements of sub-chapter 4.1 (FSS Code). The fixed fire detection system shall be capable of rapidly detecting the onset of fire*. The type of detectors and their spacing and location shall be to the satisfaction of the Administration taking into account the effects of ventilation and other relevant factors. After being installed the system shall be tested under normal ventilation conditions and shall give an overall response time to the satisfaction of the Administration. (SOLAS II-2/20.4.1)

*** IMO interpretation**

The 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 should be adapted to the time of loading/unloading. The central unit should indicate whether the detector sections are disconnected or not.

However, manual call points should not be capable of being disconnected by the arrangements referred to above.. (MSC/Circ.1120)

Additional requirements for fire detection system, in connection with deluge system, are specified in par. 3.4.3.4.8.

11.1.20.3.2 Manually operated call points in special category spaces

Manually operated call points shall be spaced so that no part of the space is more than 20 m from a manually operated call point, and one shall be placed close to each exit from such spaces. (SOLAS II-2/20.4.3.2)

11.1.20.3.3 Video monitoring system

11.1.20.3.3.1 Ro-ro and special category spaces shall be provided with a colour video monitoring system of these spaces and be provided with immediate playback capability to allow for quick identification of fire location, as far as practicable. The system shall cover all vehicle decks, including moveable platforms. Video monitors shall be available in continuously manned control station or fire centre. (MSC.1/Circ.1615, p. 2.2.2)

11.1.20.3.3.2 The system is intended for rapid confirmation of a fire after activation of fire alarms, as well as rapid execution of related actions after the confirmation of fire. This supports the activation of the correct deluge section, as well as manual fire-fighting. The system is intended also for monitoring the presence of unauthorized persons during the voyage. (MSC.1/Circ.1615, p. 2.2.1)

11.1.20.4 Structural protection

11.1.20.4.1 Notwithstanding the provisions of sec. 11.1.2 (SOLAS reg. II-2/9.2.2), 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) and (10) space, as defined in sec. 11.1.2.3 (SOLAS reg. II-2/9.2.2.3), is on one side of the division the standard may be reduced to "A-0". Where fuel oil tanks are below a special category space or a ro-ro space, the integrity of the deck between such spaces, may be reduced to "A-0" standard. (SOLAS II-2/9.6.1, SOLAS II-2/20.5)

11.1.20.4.2 In passenger ships, indicators shall be provided on the navigating bridge which shall indicate when any fire door leading to or from the special category spaces is closed. (SOLAS II-2/9.6.2)

11.1.20.4.3 In ro-ro and special category spaces, all electrical cables of the systems having a significant impact on the safety of the ship and pipelines of hydraulic systems and systems with liquid fuel under pressure joint by connections other than welding, installed under the ceiling of the spaces, should be protected by a metallic covers against damage due to the fire of vehicles in these spaces. Instead of using steel covers for electric cables, such cables can be fire-resistant type.

11.1.20.5 Fire-extinction*

IACS interpretation

The requirements for a fixed fire extinguishing system, fire detection, foam applicators and portable extinguishers need not apply to weather decks used for the carriage of vehicle with fuel in their tanks. (IACS UI SC73)

11.1.20.5.1 Fixed fire-extinguishing systems

11.1.20.5.1.1 Vehicle spaces and ro-ro spaces not capable of being sealed and special category spaces shall be fitted with a fixed water-based fire-fighting system for ro-ro spaces and special category spaces complying with the provisions of sec. 3.4.2 (FSS Code) which shall protect all parts of any deck and vehicle platform in such spaces. Such a water-based fire-fighting system shall have:

.1 a pressure gauge on the valve manifold;
.2 clear marking on each manifold valve indicating the spaces served;
.3 instructions for maintenance and operation located in the valve room; and
.4 a sufficient number of drainage valves to ensure complete drainage of the system. (SOLAS II-2/20.6.1.2)

11.1.20.5.1.2 Special category spaces alternatively can be fitted with a fixed high-expansion foam fire-extinguishing system complying with the provisions of sec. 3.5.3 (FSS Code). Effective means for removing foam after the fire has been extinguished should be provided.

It should be possible to operate the foam system and at least one ventilation exhaust fan simultaneously, to remove air from the space during the production of foam. This fan can be supplied from the main switchboard, but power and control cables should be routed independent of the protected space.

11.1.20.5.1.3 The Administration may permit the use of any other fixed fire-extinguishing system* that has been shown that it is not less effective by a full-scale test in conditions simulating a flowing petrol fire in a vehicle space or a ro-ro space in controlling fires likely to occur in such a space. (SOLAS II-2/20.6.1.3)

* Refer to *Revised Guidelines for the design and approval of fixed water-based fire-fighting systems for ro-ro spaces and special category spaces* (MSC.1/Circ.1430/Rev.3).

11.1.20.5.1.4 When fixed pressure water-spraying systems are fitted, the drainage system, complying with sec. 11.3.1 of *Part VI*, shall be provided.

11.1.20.5.1.5 Carbon dioxide systems shall not be used for the protection of special category spaces. (FSS Code, Ch. 5/2.2.1.2)

11.1.20.5.2 Portable fire extinguishers

See requirements of sec. 11.3.1.4.3. (SOLAS II-2/20.6.2)
For ro-ro passenger ships, see also sec. 11.1.20.7.

11.1.20.5.3 Water fire main system

The system shall comply with requirements of sec. 11.3.1.4.3. (SOLAS II-2/10.2.1.5.1)

11.1.20.6 Fire protection of helicopter operating areas

Ships provided with winching area and helicopter landing area shall comply additional requirements of sub-chapter 12.8.

11.1.21 Requirements for passenger ships engaged on domestic voyages – additional mark: Class A, Class B, Class C or Class D

Fire protection of these ships shall comply with applicable requirements of *Publication 100/P*.

11.1.22 Passenger ship tenders

Fire protection of passenger ship tenders intended for transferring more than 12 passengers from a stationary passenger ship to a shore and back should comply with guidelines given in MSC.1/Circ.1417/Corr.1, Chapter 4.

11.2 Container ships – additional mark: CONTAINER SHIP

11.2.1 Fire detection system

Each cargo hold shall be provided with a fire detection and fire alarm system, complying with relevant requirements of sub-chapter 4.1.

11.2.2 Fire protection of open-top container holds

11.2.2.1 For open-top container holds and on deck container stowage areas on ships designed to carry containers on or above the weather deck, fire protection arrangements shall be provided for the purpose of containing a fire in the space or area of origin and cooling adjacent areas to prevent fire spread and structural damage. (SOLAS II-2/10.1.2)

11.2.2.2 Open-top container holds shall be protected by a fixed water spraying fire-extinguishing system complying with sec. 3.4.6. (MSC/Circ.608/Rev.1, An. par. 9.2)

11.2.2.3 Whenever a fire detection system is required in the open hold area, the fire detection system shall be designed and arranged to take account of the specific hold and container configuration and ventilation arrangement. (MSC/Circ.608/Rev.1, An. par. 9.5)**Firefighting for ships designed to carry containers on or above the weather deck**

11.2.3.1 Water mist lance

11.2.3.1.1 Ships shall carry, in addition to the equipment and arrangements required by 11.2.3.2 (par. 1 and 2), at least one (1) water mist lance. (SOLAS II-2/10.7.3.1)

11.2.3.1.2 The water mist lance shall consist of a tube with a piercing nozzle which is capable of penetrating a container wall and producing water mist inside a confined space (container, etc.) when connected to the fire main. (SOLAS II-2/10.7.3.1.1)

11.2.3.2 Additional requirements for container ships designed to carry five (5) or more tiers of containers on or above the weather deck

11.2.3.2.1 Ships designed to carry five (5) or more tiers of containers on or above the weather deck shall carry, in addition to the requirements of par. 11.2.3.1.1 (SOLAS par. 10.7.3.1), mobile water monitors * as follows:

- **.1** ships with breadth less than 30 m: at least two (2) mobile water monitors; or
- **.2** ships with breadth of 30 m or more: at least four (4) mobile water monitors. (SOLAS II-2/10.7.3.2)

* Refer to the *Guidelines for the design, performance, testing and approval of mobile water monitors used for the protection of on-deck cargo areas of ships designed and constructed to carry five or more tiers of containers on or above the weather deck* (MSC.1/Circ.1472).

11.2.3.2.2 There shall be a place provided on weather deck, among the transverse bays of containers for moving the mobile water monitors and places for fixing the monitors to the ship structure, to ensure the possibility of delivering water to each tier of containers in a bay, from each side.

11.2.3.2.3 The mobile water monitors, all necessary hoses, fittings and required fixing hardware shall be kept ready for use in a location outside the cargo space area not likely to be cut-off in the event of a fire in the cargo spaces. (SOLAS II-2/10.7.3.2.1)

11.2.3.2.4 A sufficient number of fire hydrants shall be provided such that:

- **.1** all provided mobile water monitors can be operated simultaneously for creating effective water barriers forward and aft of each container bay;
- **.2** the two (2) jets of water required by par. 3.2.1.5 (SOLAS par. 10.2.1.5.1) can be supplied at the pressure required by par. 3.2.1.6 (SOLAS par. 10.2.1.6); and
- **.3** each of the required mobile water monitors can be supplied by separate hydrants at the pressure necessary to reach the top tier of containers on deck. (SOLAS II-2/10.7.3.2.2)

11.2.3.2.5 The mobile water monitors may be supplied by the fire main, provided the capacity of fire pumps and fire main diameter* are adequate to simultaneously operate the mobile water monitors and two jets of water from fire hoses at the required pressure values. If carrying dangerous goods, the capacity of fire pumps and fire main diameter shall also comply with par. 7.2.1.5 (SOLAS reg. 19.3.1.5), as far as applicable to on-deck cargo areas. (SOLAS II-2/10.7.3.2.3)

* ***IACS and IMO interpretation***

1. *On board cargo ships designed to carry five or more tiers of containers on or above the weather deck:*
   .1 in cases where the mobile water monitors are supplied by separate pumps and piping system, the total capacity of the main fire pumps need not exceed 180 m³/h and the diameter of the fire main and water service pipes (hereinafter referred to "the pipework diameter") need only be sufficient for the discharge of 140 m³/h.
   .2 in cases where the mobile water monitors are supplied by the main fire pumps; the total capacity of required main fire pumps and the pipework diameter shall be sufficient for simultaneously supplying both the required number of fire hoses and mobile water monitors. However, the total capacity shall not be less than the following .1 or .2, whichever is smaller:
      .1 four thirds (4/3) of the quantity required under SOLAS reg. II-1/35-1 to be dealt with by each of the independent bilge pumps in a passenger ship of the same dimension when employed in bilge pumping; or
      .2 180 m³/h.
   .3 in cases where the mobile water monitors and the "water spray system" (fixed arrangement of spraying nozzles or flooding the cargo space with water) required by par.7.2.1.3 (SOLAS reg. II-2/19.3.1.3) are supplied by the main fire pumps, the total capacity of the main fire pumps and the pipework diameter need only be sufficient to supply whichever of the following is the greater:
      .1 the mobile water monitors and the four nozzles required by par.7.2.1.2 (SOLAS reg. II-2/19.3.1.2); or
      .2 the four (4) nozzles required by par.7.2.1.2 (SOLAS reg. II-2/19.3.1.2) and the water spray system required by par.7.2.1.3 (SOLAS reg. II-2/19.3.1.3). The total capacity, however, is not to be less than 1.2.1 or 1.2.2, whichever is smaller.
2. *On board cargo ships designed to carry five (5) or more tiers of containers on or above the weather deck, the total capacity of the emergency fire pump need not exceed 72 m³/h. (IACS UI SC270, MSC.1/Circ.1550)*

11.2.3.2.6 The operational performance of each mobile water monitor shall be tested during initial survey on board the ship to the satisfaction of the Administration. The test shall verify that:

.1 the mobile water monitor can be securely fixed to the ship structure ensuring safe and effective operation; and

.2 the mobile water monitor jet reaches the top tier of containers with all required monitors and water jets from fire hoses operated simultaneously. (SOLAS II-2/10.7.3.2.4)

11.2.3.3 Firefighter's outfits

It is recommended, that the ship designed to carry five (5) or more tiers of containers on or above the weather deck, be provided with in total eight (8) sets of firefighter's outfits, which shall comply with sub-chapter 5.4.

At least one thermal imaging camera should be provided on board the ship, for use by firefighters.

11.2.3.4 Firefighters radio communication

It is recommended, that at least two (2) of the portable radiotelephone apparatus, required in sec. 6.7.4, should be specially adapted for use by the fire-fighting team, e.g. installed inside helmet, for communication firefighters in cargo area with the bridge.

11.3 Roll on-roll off ships – additional marks: RO-RO SHIP, RO-RO SHIP (FERRY), VEHICLE CARRIER

11.3.1 Fire protection of vehicle and ro-ro spaces

11.3.1.1 General requirements

11.3.1.1.1 Application

11.3.1.1.1.1 In addition to complying with the requirements of this *Part V* (SOLAS reg. in parts B, C, D and E), as appropriate, vehicle (…) and ro-ro spaces shall comply with the requirements of this sub-chapter11.3 (regulation). (SOLAS II-2/20.2.1.1)

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

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

.2 the cargo spaces are in compliance with the appropriate requirements of chapter 7 (SOLAS reg. II-2/19); and

.3 the vehicles are carried in accordance with the IMDG Code, as defined in SOLAS reg. VII/1.1. (SOLAS II-2/20.2.1.2)

11.3.1.2 Precaution against ignition of flammable vapours in closed vehicle spaces and closed ro-ro spaces

11.3.1.2.1 Ventilation systems

See sec. 17.3.3 of *Part VI*.

11.3.1.2.1.1 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. (SOLAS II-2/20.3.1.5)

It is recommended, that the openings shall be equipped with metal shutters/covers that will allow them to be closed remotely in the event of fire, from a safe and easily accessible place outside the ro-ro/vehicle space.

11.3.1.2.1.2 Location of ventilation inlet or outlet

Any ventilation inlet or outlet from a ro-ro/ special category spaces shall be located in save distance from lifeboats, air intakes to engine rooms, emergency generator room and accommodation, to the satisfaction of Administration.

11.3.1.2.2 Electrical equipment and wiring*

* See *Interim guidelines for minimizing the incidence and consequences of fires in ro-ro spaces and special category spaces of new and existing ro-ro passenger ships* - MSC.1/Circ.1615 (item 1.4).

11.3.1.2.2.1 Except as provided in par. 11.3.1.2.2.2 (SOLAS II-2/20.3.2.2), electrical equipment and wiring shall be of a type suitable for use in an explosive petrol and air mixture.* (SOLAS II-2/20.3.2.1)

* Refer to the recommendations of the International Electrotechnical Commission, in particular IEC publication 60079, *Electrical apparatus for explosive gas atmospheres.*

IACS and IMO interpretation

This is realized by requiring certified safe equipment suitable for use in Zone 1 areas as defined in IEC 60079-10-1:2015 (Gas Group IIA and Temperature Class T3). Refer to IEC 60079-14:2013 for types of protection suitable for use in Zone 1 areas. (IACS UI SC43, MSC/Circ.1120)

11.3.1.2.2.2 In case of other than special category spaces below the bulkhead deck, notwithstanding the provisions in par. 11.3.1.2.2.1 (SOLAS II-2/20.3.2.1), above a height of 450 mm from the deck and from each platform for vehicles, if fitted, except platforms with openings of sufficient size permitting penetration of petrol gases downwards, electrical equipment of a type so enclosed and protected as to prevent the escape of sparks* shall be permitted as an alternative on condition that the ventilation system is so designed and operated as to provide continuous ventilation of the cargo spaces at the rate of at least ten air changes per hour whenever vehicles are on board. (SOLAS II-2/20.3.2.2)

*** IACS interpretation**

This is realized by requiring an enclosure of at least IP55, or apparatus suitable for use in Zone 2 areas as defined in IEC Publication 60079-10-1:2015. Refer to IEC Publication 60079-14:2013 for types of protection suitable for use in Zone 2 areas. (IACS UI SC42)

11.3.1.2.3 Electrical equipment and wiring in exhaust ventilation ducts

Electrical equipment and wiring*, if installed in an exhaust ventilation duct, shall be of a type approved for use in explosive petrol and air mixtures and the outlet from any exhaust duct shall be sited in a safe position, having regard to other possible sources of ignition. (SOLAS II-2/20.3.3)

*** IACS and IMO interpretation**

This is realized by requiring certified safe equipment suitable for use in Zone 1 areas as defined in IEC 60079-10-1:2015 (Gas Group IIA and Temperature Class T3). Refer to IEC 60079-14:2013 for types of protection suitable for use in Zone 1 areas. (IACS UI SC43, MSC/Circ.1120)

11.3.1.2.4 Other ignition sources

Other equipment which may constitute a source of ignition of flammable vapours shall not be permitted. (SOLAS II-2/20.3.3.4)

11.3.1.2.5 Scuppers and discharges

Scuppers shall not be led to machinery or other spaces where sources of ignition may be present. (SOLAS II-2/20.3.5)

11.3.1.2.6 Electrical connections on ro-ro decks serving reefer unit

11.3.1.2.6.1 Sockets serving reefer units and other consumers on ro-ro deck shall be of safe design and designed according to a recognised standard. Sockets shall be arranged so that they will not be damaged during loading and unloading of vehicles. It is recommended that the sockets are suspended from the ceiling of the ro-ro/ special category space.

11.3.1.2.6.2 Power supply circuits serving such units shall be monitored for short circuit/ground fault with alarm to a continuously manned control station. Means to isolate these circuits shall be readily accessible for the crew and clearly marked.

11.3.1.3 Detection and alarm*

*** IACS interpretation**

The requirements for a fixed fire extinguishing system, fire detection, foam applicators and portable extinguishers need not apply to weather decks used for the carriage of vehicle with fuel in their tanks. (IACS UI SC73)

11.3.1.3.1 Fixed fire detection and fire alarm systems

Ro-ro and vehicle spaces (...) shall be provided with a fixed fire detection and fire alarm system complying with the requirements of sub-chapter 4.1 (FSS Code). The fixed fire detection system shall be capable of rapidly detecting the onset of fire*. The type of detectors and their spacing and location shall be to the satisfaction of the Administration taking into account the effects of ventilation and other relevant factors. After being installed the system shall be tested under normal ventilation conditions and shall give an overall response time to the satisfaction of the Administration. (SOLAS II-2/20.4.1)

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* ***IMO interpretation***

The 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 should be adapted to the time of loading/unloading. The central unit should indicate whether the detector sections are disconnected or not.

However, manual call points should not be capable of being disconnected by the arrangements referred to above. (MSC/Circ.1120)

Additional requirements for fire detection system, in connection with deluge system, are given in par. 3.4.3.4.8.

11.3.1.3.2 Sample extraction smoke detection systems

Except open ro-ro spaces, open vehicle spaces and special category spaces, a sample extraction smoke detection system complying with the requirements of sub-chapter 4.2 (FSS Code) may be used as an alternative of the fixed fire detection and fire alarm system required in par. 4.1.3.1 (SOLAS II-2/20.4.1). (SOLAS II-2/20.4.2)

11.3.1.4 Fire-extinction*

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* ***IACS interpretation***

The requirements for a fixed fire extinguishing system, fire detection, foam applicators and portable extinguishers need not apply to weather decks used for the carriage of vehicle with fuel in their tanks. (IACS UI SC73)

11.3.1.4.1 Fixed fire-extinguishing systems

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

.1 a fixed gas fire-extinguishing system complying with the provisions of sub-chapter 3.6 (FSS Code);

For CO_2 systems, it is recommended, that a connection from the water fire main system to the CO_2 discharge piping be provided. This connection should be non-permanent (spool piece or fire hose to be used) and located in CO_2 control room. It shall be possible to release the water through any of the CO_2 section valves. The purpose of this solution is to cool down the space on fire after a CO_2 release or in case the CO_2 system fails to operate. It can also be applied to cool down the cargo space above the space on fire.

.2 a fixed high-expansion foam fire-extinguishing system complying with the provisions of sec. 3.5.3 (FSS Code);

It should be possible to operate the foam system and at least one ventilation exhaust fan simultaneously - for removal of air from the space during producing the foam. This fan can be served by power from the main switchboard, but power and control cables should be routed independent of the protected space.

or

.3 a fixed water-based fire-fighting system for ro-ro spaces and special category spaces complying with the provisions of sec. 3.4.2 (FSS Code) and par. 11.3.1.4.1.2 below (SOLAS II-2/20, par. 6.1.2.1 to 6.1.2.4). (SOLAS II-2/20.6.1.1)

11.3.1.4.1.2 Vehicle spaces and ro-ro spaces not capable of being sealed and special category spaces shall be fitted with a fixed water-based fire-fighting system for ro-ro spaces and special category spaces complying with the provisions of sec. 3.4.2 (FSS Code) which shall protect all parts of any deck and vehicle platform in such spaces. Such a water-based fire-fighting system shall have:

.1 a pressure gauge on the valve manifold;
.2 clear marking on each manifold valve indicating the spaces served;
.3 instructions for maintenance and operation located in the valve room; and
.4 a sufficient number of drainage valves to ensure complete drainage of the system. (SOLAS II-2/20.6.1.2)

11.3.1.4.1.3 The Administration may permit the use of any other fixed fire-extinguishing system* that has been shown that it is not less effective by a full-scale test in conditions simulating a flowing petrol fire in a vehicle space or a ro-ro space in controlling fires likely to occur in such a space. (SOLAS II-2/20.6.1.3)

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* Refer to *Revised Guidelines for the design and approval of fixed water-based fire-fighting systems for ro-ro spaces and special category spaces* (MSC.1/Circ.1430/Rev.3).

11.3.1.4.1.4 When fixed pressure water-spraying systems are fitted, the drainage system complying with sec. 17.3.1 of *Part VI*, , shall be provided.

11.3.1.4.2 Portable fire extinguishers

11.3.1.4.2.1 Portable 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. (SOLAS II-2/20.6.2.1)

The required portable extinguishers shall be approved 12 kg powder or 9 l foam portable extinguishers. Portable extinguishers should be located at easily accessible positions, such as along walkways or entry points to the ro-ro space.

IMO interpretation

The requirements set out in this regulation need not to be applied to weather decks used as ro-ro cargo spaces. (MSC/Circ.1120)

11.3.1.4.2.2 In addition to the provision of par. 11.3.1.4.3.1 (SOLAS II-2/20.6.2.1), the following fire extinguishing appliances* shall be provided in vehicle, ro-ro and special category spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion:

.1 at least three water-fog applicators;
.2 one portable foam applicator unit complying with the provisions of sec. 5.3 (FSS Code), provided that at least two such units are available in the ship for use in such ro-ro spaces; (SOLAS II-2/20.6.2.2) and
.3 at least two mobile dry powder fire extinguishers, with a capacity of at least 25 kg.

*** *IACS and IMO interpretation***

Cargo holds loaded with vehicles with fuel in their tanks which are stowed in open or closed containers need not be provided with portable fire extinguishers, water-fog applicators and foam applicator units. (IACS UI SC205, MSC.1/Circ.1239)

11.3.1.4.3 Water fire main system

11.3.1.4.3.1 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 space or any vehicle space or any special category space in which latter case the two jets shall reach any part of the space, each from a single length of hose. Furthermore, such hydrants shall be positioned near the accesses to the protected spaces. (SOLAS II-2/10.2.1.5.1)

11.3.1.4.3.2 In ro-ro/ vehicle and special category spaces, fire hydrants shall be so arranged and located that they are always easily accessible both during loading and unloading, as well as during the transport of vehicles in these spaces.

11.3.1.4.3.3 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 space or any vehicle space or any special category space in which latter case the two jets shall reach any part of the space, each from a single length of hose. Furthermore, such hydrants shall be positioned near the accesses to the protected spaces. (SOLAS II-2/10.2.1.5.1)

11.3.1.4.3.4 In ro-ro/ vehicle and special category spaces, fire hydrants shall be so arranged and located that they are always easily accessible both during loading and unloading, as well as during the transport of vehicles in these spaces.

11.3.2 Means of escape from vehicle and ro-ro spaces

See requirements of sec.2.3.4.

11.3.3 Requirements for vehicle carriers* carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo

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* ***IMO interpretation***

The definition of vehicle carrier in par. 1.2.56 (SOLAS reg. II-2/3.56) is intended for pure car and truck carriers, and should exclude other types of ro-ro cargo ships or container/ro-ro ships, even when carrying empty cars and trucks as cargo. (MSC.1/Circ.1555)

11.3.3.1 Application

In addition to complying with the requirements of sub-chapters 11.3 (SOLAS reg. II-2/20), as appropriate, vehicle carriers intended for the carriage of motor vehicles with compressed hydrogen or compressed natural gas in their tanks for their own propulsion as cargo shall comply with the requirements in sec. 11.3.3.2 to 11.3.3.4 (SOLAS II-2/20-1, par. 3 to 5). (SOLAS II-2/20-1/2.1)

11.3.3.2 Requirements for spaces intended for carriage of motor vehicles with compressed natural gas in their tanks for their own propulsion as cargo

11.3.3.2.1 Electrical equipment and wiring

All electrical equipment and wiring shall be of a certified safe type for use in an explosive methane and air mixture*. (SOLAS II-2/20-1/3.1)

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* Refer to the recommendations of the International Electrotechnical Commission, in particular, publication IEC 60079.

11.3.3.2.2 Ventilation arrangement

11.3.3.2.2.1 Electrical equipment and wiring, if installed in any ventilation duct, shall be of a certified safe type for use in explosive methane and air mixtures. (SOLAS II-2/20-1/3.2.1)

11.3.3.2.2.2 Requirements for fans – *see Part VI*, 17.3.3.9. (SOLAS II-2/20-1/3.2.2)

11.3.3.2.3 Other ignition sources

Other equipment which may constitute a source of ignition of methane and air mixtures shall not be permitted. (SOLAS II-2/20-1/3.3)

11.3.3.3 Requirements for spaces intended for carriage of motor vehicles with compressed hydrogen in their tanks for their own propulsion as cargo

11.3.3.3.1 Electrical equipment and wiring

All electrical equipment and wiring shall be of a certified safe type for use in an explosive hydrogen and air mixture*. (SOLAS II-2/20-1/4.1)

* Refer to the recommendations of the International Electrotechnical Commission, in particular, publication IEC 60079.

11.3.3.3.2 Ventilation arrangement

11.3.3.3.2.1 Electrical equipment and wiring, if installed in any ventilation duct, shall be of a certified safe type for use in explosive hydrogen and air mixtures and the outlet from any exhaust duct shall be sited in a safe position, having regard to other possible sources of ignition. (SOLAS II-2/20-1/4.2.1)

11.3.3.3.2.2 Requirements for fans – *see Part VI*, 17.3.3.9 (SOLAS II-2/20-1/4.2.2)

11.3.3.3.3 Other ignition sources

Other equipment which may constitute a source of ignition of hydrogen and air mixtures shall not be permitted. (SOLAS II-2/20-1/4.3)

11.3.3.4 Detection

When a vehicle carrier carries as cargo one or more motor vehicles with either compressed hydrogen or compressed natural gas in their tanks for their own propulsion, at least two portable gas detectors shall be provided. Such detectors shall be suitable for the detection of the gas fuel and be of a certified safe type for use in the explosive gas and air mixture. (SOLAS II-2/20-1/5)

11.4 Bulk carriers and combination carriers – additional marks: BULK CARRIER, SELF-UNLOADING BULK CARRIER, ORE CARRIER, CEMENT CARRIER, ORE CARRIER/CRUDE OIL TANKER, BULK CARRIER/ORE CARRIER/CRUDE OIL TANKER

There are no additional requirements with regard to fire protection of such ships.

11.5 General cargo ships – additional marks: DRY CARGO SHIP, CEMENT CARRIER

There are no additional requirements with regard to fire protection of such ships.

11.6 Oil tankers – additional marks: CRUDE OIL TANKER, PRODUCT CARRIER A, PRODUCT CARRIER B

11.6.1 Scope of application

11.6.1.1 Requirements for tankers in this *Part V* (SOLAS, chapter II-2) shall apply to tankers carrying crude oil or petroleum products having a flashpoint not exceeding 60°C (closed cup test), as determined by an approved flashpoint apparatus, and a Reid vapour pressure which is below the atmospheric pressure or other liquid products having a similar fire hazard. (SOLAS II-2/1.6.1)

11.6.1.2 Where liquid cargoes other than those referred to in par. 11.6.1.1 (SOLAS par. 6.1) or liquefied gases which introduce additional fire hazards are intended to be carried, additional safety measures shall be required, having due regard to the provisions of *IBC Code*, as defined in SOLAS reg. VII/8.1 (...), *IGC Code*, as defined in SOLAS reg. VII/11.1, (...) as appropriate. (SOLAS II-2/1.6.2)

11.6.1.3 Tankers carrying petroleum products with a flashpoint exceeding 60°C (closed cup test), as determined by an approved flashpoint apparatus, shall comply with the requirements provided in par. 11.6.4.8.1.1 (isolation valves in water fire main) and 11.6.4.9 (fire-fighter's outfits) (SOLAS reg. 10.2.1.4.4. and 10.10.2.3) and the requirements for cargo ships other than tankers, except that, in lieu of the fixed fire extinguishing system required in sec. 6.5.1 (SOLAS reg. 10.7), they shall be fitted with a fixed deck foam system* which shall comply with the provisions of sec. 11.6.5 (FSS Code). (SOLAS II-2/1.6.4)

**** IACS interpretation***

Ships of less than 2.000 tons gross tonnage carrying petroleum products having a flash point exceeding 60 ℃ (c.c. test) are not required to be fitted with a fixed fire extinguishing system. (IACS UI SC48)

11.6.1.4 Combination carriers shall not carry cargoes other than oil unless all cargo spaces are empty of oil and gas-freed or unless the arrangements provided in each case have been be approved by the Administration taking into account the guidelines developed by the Organization.* (SOLAS II-2/1.6.5)

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* Refer to *Guidelines for inert gas systems* - MSC/Circ.353, as amended by MSC/Circ.387.

11.6.2 Cargo areas of tankers

11.6.2.1 Separation of cargo oil tanks

11.6.2.1.1 Cargo pump-rooms, cargo tanks, slop tanks and cofferdams[1)] shall be positioned forward of machinery spaces. However, oil fuel bunker tanks need not be forward of machinery spaces. Cargo tanks and slop tanks shall be isolated from machinery spaces by cofferdams, cargo pump-rooms, oil bunker tanks or ballast tanks[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 sub-chapter 11.6 (regulation) provided that such pump-rooms have the same safety standard as that required for cargo pump-rooms[3)]. Pump-rooms intended solely for ballast or oil fuel transfer, however, need not comply with the requirements of sec. 11.6.4.7 (protection of cargo pump rooms) (SOLAS reg. 10.9). The lower portion of the pump-room may be recessed into machinery spaces of category A to accommodate pumps, provided that the deck head of the recess is in general not more than one third of the moulded depth above the keel, except that in the case of ships of not more than 25,000 tonnes deadweight, where it can be demonstrated that for reasons of access and satisfactory piping arrangements this is impracticable, the Administration may permit a recess in excess of such height, but not exceeding one half of the moulded depth above the keel. (SOLAS II-2/4.5.1.1)

IACS and IMO interpretations

1) *The expression "cofferdam" means, for the purpose of this regulation, an isolating space between two adjacent steel bulkheads or decks. The minimum distance between the two bulkheads or decks is to be sufficient for safe access and inspection. In order to meet the single failure principle, in the particular case when a corner-to-corner situation occurs, this principle may be met by welding a diagonal plate across the corner. No cargo, wastes or other goods are to be contained in cofferdams. (IACS UI SC54 MSC/Circ. 1120)*

2) *Void space or ballast water tank protecting a fuel oil tank (...), as shown in figure 1 of MSC.1/Circ.1239, need not be considered as a "cargo area" as defined in par.1.2.6 (SOLAS reg. II-2/3.6) even though they have a cruciform contact with the cargo oil tank or slop tank.*

The void space protecting a fuel oil tank (...), is not considered as a cofferdam as specified in this par.11.6.2.1.1 (SOLAS reg. II-2/4.5.1.1. Therefore, location of the void space shown in figure 1 of MSC.1/Circ.1239 should be considered acceptable even though they have a cruciform contact with the slop tank. (IACS UI SC211, MSC.1/Circ.1239)

3) *Pump-rooms intended solely for ballast transfer need not comply with the requirements of sec. 11.6.4.7.3 (measures to prevent explosions in cargo pump rooms) (SOLAS reg. II-2/4.5.10). The requirements of sec. 11.6.4.7.3 (SOLAS reg. II-2/4.5.10) are only applicable to the pump-rooms, regardless of their location, where pumps for cargo, such as cargo pumps, stripping pumps, pumps for slop tanks, pumps for COW or similar pumps are provided. (IACS UI SC188, MSC/Circ.1037, MSC/Circ. 1120)*

"Similar pumps" includes pumps intended for transfer of fuel oil having a flashpoint not exceeding of less than 60 °C. Pump-rooms intended for transfer of fuel oil having a flashpoint exceeding of not less than 60 °C need not comply with the requirements of sec. 11.6.4.7.3 (SOLAS reg. II-2/4.5.10). (IACS UI SC188)

In order to ensure fire safety in pump rooms, the guidelines given in MSC.1/Circ.1321 should be followed when designing, constructing and maintaining installations and equipment.

11.6.2.1.2 Main cargo control stations, control stations, accommodation and service spaces* (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 arranged in such a way that a single failure of a deck or bulkhead shall not permit the entry of gas or fumes from the cargo tanks into an accommodation space, main cargo control stations, control station, or service spaces. A recess provided in accordance with par. 11.6.2.1.1 (SOLAS par. 5.1.1) need not be taken into account when the position of these spaces is being determined. (SOLAS II-2/4.5.1.2)

**** IACS and IMO interpretation***
Paint lockers, regardless of their use, cannot be located above the tanks and spaces defined in this par. 11.6.2.1.2 (SOLAS II-2/4.5.1.2) for oil tankers and the cargo area for chemical tankers. (IACS UI SC201, MSC.1/Circ.1239)

11.6.2.1.3 However, where deemed necessary, the Administration may permit main cargo control stations, control stations, accommodation and service spaces forward of the cargo tanks, slop tanks and spaces which isolate cargo and slop tanks from machinery spaces, but not necessarily forward of oil fuel bunker tanks or ballast tanks. Machinery spaces, other than those of category A, may be permitted forward of the cargo tanks and slop tanks provided they are isolated from the cargo tanks and slop tanks by cofferdams, cargo pump-rooms, oil fuel bunker tanks or ballast tanks, and have at least one portable fire extinguisher. In cases where they contain internal combustion machinery, one approved foam-type extinguisher of at least 45 *l* capacity or equivalent shall be arranged in addition to portable fire extinguishers. If operation of a semi-portable fire extinguisher is impracticable, this fire extinguisher may be replaced by two additional portable fire extinguishers. Accommodation spaces, main cargo control spaces, control stations and service spaces shall be arranged in such a way that a single failure of a deck or bulkhead shall not permit the entry of gas or fumes from the cargo tanks into such spaces. In addition, where deemed necessary for the safety or navigation of the ship, the Administration may permit machinery spaces containing internal combustion machinery not being main propulsion machinery having an output greater than 375 kW to be located forward of the cargo area provided the arrangements are in accordance with the provisions of this paragraph. (SOLAS II-2/4.5.1.3)

11.6.2.1.4 In combination carriers only:

.1 the slop tanks shall be surrounded by cofferdams except where the boundaries of the slop tanks, where slop may be carried on dry cargo voyages, are part of the hull, main cargo deck, cargo pump-room bulkhead or oil fuel bunker tank. These cofferdams 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 may be permitted;

.2 means shall be provided for isolating the piping connecting the pump-room with the slop tanks referred to in par. 11.6.2.1.4.1 (SOLAS par. 5.1.4.1). The means of isolation shall consist of a valve followed by a spectacle flange or a spool piece with appropriate blank flanges. This arrangement shall be located adjacent to the slop tanks, but where this is unreasonable or impracticable, it may be located within the pump-room directly after the piping penetrates the bulkhead. A separate permanently installed pumping and piping arrangement incorporating a manifold, provided with a shut-off valve and a blank flange, shall be provided for discharging the contents of the slop tanks directly to the open deck for disposal to shore reception facilities when the ship is in the dry cargo mode. When the transfer system is used for slop transfer in the dry cargo mode, it shall have no connection to other systems. Separation from other systems by means of removal of spool pieces may be accepted;

.3 hatches and tank cleaning openings to slop tanks 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 under the control of the responsible ship' s officer; and

.4 where cargo wing tanks are provided, cargo oil lines below deck shall be installed inside these tanks. However, the Administration may permit cargo oil lines to be placed in special ducts provided there are capable of being adequately cleaned and ventilated to the satisfaction of the Administration. Where cargo wing tanks are not provided, cargo oil lines below deck shall be placed in special ducts. (SOLAS II-2/4.5.1.4)

11.6.2.1.5 Cargo openings in the bottoms of topside tanks of ships carrying alternatively oil and grain

Ships carrying alternatively oil having a flash point not exceeding 60°C (closed cup test) or other cargoes.

When ships are designed to transport alternatively oil or dry cargoes, openings which may be used for cargo operations are not permitted in bulkheads and decks separating oil cargo spaces from other spaces not designed and equipped for the carriage of oil cargoes unless alternative approved means are provided to ensure equivalent integrity. (IACS UR F27)

11.6.2.1.6 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. The fire protection requirements for such a navigation position shall be that required for control stations, as specified in sec. 11.6.3.2 (Fire integrity of bulkheads and decks) (SOLAS reg. 9.2.4.2) and other provisions for tankers, as applicable. (SOLAS II-2/4.5.1.5)

11.6.2.1.7 Means shall be provided to keep deck spills away from the accommodation and service areas. This may be accomplished by provision of a permanent continuous coaming of a height of at least 300 mm, extending from side to side. Special consideration shall be given to the arrangements associated with stern loading. (SOLAS II-2/4.5.1.6)

Where a stern loading station is installed on board the ship, such coaming shall also be provided at the stern bulkhead of the superstructure.

11.6.2.2 Restriction on boundary openings

11.6.2.2.1 Except as permitted in par. 11.6.2.2.2 (SOLAS par. 5.2.2), 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 need not exceed 5 m. (SOLAS II-2/4.5.2.1)

*** *IACS and IMO interpretations***

If, under the requirements of the SOLAS Convention, the IBC Code or the IGC Code (e.g. SOLAS regulations II-2/4.5.2.1, 4.5.2.2, 4.5.3.4.1, 11.6.2 and 16.3.2.3; IBC Code, paragraphs 3.2.3, 3.7.4, 8.3.4 and 8.5.1; and IGC Code, paragraphs 3.2.4, 3.8.4, 8.2.9, 8.2.10 and 10.2.5.1), owing to the design of a ship, it is impossible in practice, or unreasonable, to fulfil the requirements relating to the location of access doors, air inlets or other openings in superstructures and/or deckhouses, the Administration or recognized organization acting on its behalf may adopt alternative provisions provided that, as a consequence of doing so, no ignition source is located in the hazardous areas defined in publication IEC 60092-502, except for electrical installations that have the required protection and have been certified as safe under that standard. (MSC.1/Circ.1459)

Access to forecastle spaces containing sources of ignition may be permitted through doors facing cargo area provided the doors are located outside hazardous areas as defined in IEC Publication 60092-502:1999. (IACS UI SC120)

11.6.2.2.2 The Administration may permit access doors in boundary bulkheads facing the cargo area or within the 5 m limits specified in par. 11.6.2.2.1 (SOLAS par. 5.2.1), to main cargo control stations and to such service spaces used as provision rooms, store-rooms and lockers, provided they do not give access directly or indirectly to any other space containing or providing for accommodation, control stations or service spaces such as galleys, pantries or workshops, or similar spaces containing sources of vapour ignition. The boundary of such a space shall be insulated to "A-60" standard, with the exception of the boundary facing the cargo area. Bolted plates for the removal of machinery may be fitted within the limits specified in par. 11.6.2.2.1 (SOLAS par. 5.2.1). Wheelhouse doors and windows may be located within the limits specified in par. 11.6.2.2.1 (SOLAS par. 5.2.1) so long as they are designed to ensure that the wheelhouse can be made rapidly and efficiently gas and vapour tight. (SOLAS II-2/4.5.2.2)

IACS and IMO interpretations

1. *An access to a deck foam system room (including the foam tank and the control station) can be permitted within the limits mentioned in par. 11.6.2.2.1 (SOLAS Reg. II-2/4.5.2.1), provided that the conditions listed in par. 11.6.2.2.2 (SOLAS Reg. II-2/4.5.2.2) are satisfied and that the door is located flush with the bulkhead.(IACS UI SC55)*
2. *The navigation bridge external doors and windows which are located within the limits of par. 11.6.2.2.1 (SOLAS reg. II-2/4.5.2.1) are to be tested for gas tightness. If a water hose test is applied, the following may be taken as a guide:*
   - *nozzle diameter: minimum 12 mm*
   - *water pressure just before the nozzle: not less than 2 bar*
   - *distance between the nozzle and the doors or windows: maximum 1.5 m. (IACS UI SC55, MSC/Circ.1120)*

11.6.2.2.3 Windows* and sidescuttles facing the cargo area and on the sides of the superstructures and deckhouses within the limits specified in par. 11.6.2.2.1 (SOLAS par. 5.2.1) shall be of the fixed (non-opening) type. Such windows and sidescuttles, except wheelhouse windows, shall be constructed to "A-60" class standard, except that "A-0" class standard is acceptable for windows and sidescuttles outside the limit specified in par. 11.6.3.2.5 (SOLAS reg. reg. 9.2.4.2.5). (SOLAS II-2/4.5.2.3)

*** IMO interpretation**

Windows to be fitted at the forward bulkhead of accommodation block on tankers should correspond to prototype subjected to the "A" class standard fire test with the fire against its external side (i.e., the side which, after the installation on board, will be exposed to the weather). The insulation of the bulkhead used along with the window's specimen should be fitted on the unexposed face of the structural core. (MSC.1/Circ.1203)

11.6.2.2.4 Where there is permanent access from a pipe tunnel to the main pump-room, a watertight door shall be fitted complying with the requirements of SOLAS reg. II-1/13-1.2 and, in addition, with the following:

.1 in addition to the bridge operation, the watertight door shall be capable of being manually closed from outside the main pump-room entrance; and

.2 the watertight door shall be kept closed during normal operations of the ship except when access to the pipe tunnel is required. (SOLAS II-2/4.5.2.4)

Pipe ducts in the double bottom shall comply with the following requirements:

(i) They should not communicate with the engine room.

(ii) Provision shall be made for at least two exits to the open deck arranged at a maximum distance from each other. One of these exits fitted with a watertight closure may lead to the cargo pumproom.

(iii) In the duct, provision shall be made for adequate mechanical ventilation. (IACS UR F26)

11.6.2.2.5 Permanent approved gastight lighting enclosures for illuminating cargo pump-rooms may be permitted in bulkheads and decks separating cargo pump-rooms and other spaces provided they are of adequate strength and the integrity and gas tightness of the bulkhead or deck is maintained. (SOLAS II-2/4.5.2.5)

11.6.2.2.6 The arrangement of ventilation inlets and outlets and other deckhouse and superstructure boundary space openings shall be such as to complement the provisions of sec.17.6.6 of *Part VI* (cargo tank venting) and (protection of cargo tank structure against pressure or vacuum in tankers) (SOLAS par. II-2/4.5.3 and reg. II-2/11.6). Such vents, especially for machinery spaces, shall be situated as far aft as practicable. Due consideration in this regard shall be given when the ship is equipped to load or discharge at the stern. Sources of ignition such as electrical equipment shall be so arranged as to avoid an explosion hazard. (SOLAS II-2/4.5.2.6)

11.6.3 Thermal and structural boundaries

11.6.3.1 Application

For tankers, only method IC as defined in par. 2.2.2.1 (SOLAS par. 2.3.1.1) shall be used. (SOLAS II-2/9.2.4.1)

11.6.3.2 Fire integrity of bulkheads and decks

11.6.3.2.1 In lieu of sec. 2.2.2 (SOLAS par. 2.3) and in addition to complying with the specific provisions for fire integrity of bulkheads and decks of tankers, the minimum fire integrity of bulkheads and decks shall be as prescribed in tables 9.7 and 9.8. (SOLAS II-2/9.2.4.2.1)

11.6.3.2.2 The following requirements shall govern application of the tables:

.1 Tables 9.7 and 9.8 shall apply respectively to the bulkhead and decks separating adjacent spaces;

.2 For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (10) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this sub-chapter 11.6 (regulation), or where it is possible to assign two or more classifications to a space, it shall be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed areas within a space that have less than 30 % communicating openings to that space are considered separate areas. The fire integrity of the boundary bulkheads and decks of such smaller spaces shall be as prescribed in tables 9.7 and 9.8. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables;

(1) Control stations*

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

**** IACS and IMO interpretations***

A bulkhead separating the wheelhouse and the toilet, installed completely within the wheelhouse, requires no fire rating. (MSC.1/Circ.1555)

A navigation locker that can only be accessed from the wheelhouse should be considered as a control station and the bulkhead separating the wheelhouse and such a locker should have fire integrity of at least "B-0" class. (MSC.1/Circ.1581)

Navigation equipment room (radar transmitter) and battery rooms should be treated as category (1): Control Stations. (IACS UI SC45)

(2) Corridors

- Corridors and lobbies.

(3) Accommodation spaces*

- Spaces as defined in par. 1.2.1 (SOLAS reg. 3.1), excluding corridors.

**** IMO interpretations***

Pantries or isolated pantries containing no cooking appliances may contain:

.1 toasters, microwave ovens, water boilers, induction heaters and similar appliances each of them with a maximum power of 5 kW; and

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

These pantries may also contain coffee machines, dish washers and water boilers with no exposed hot surfaces regardless of their power.

A dining room containing such appliances should not be regarded as a pantry. (MSC/Circ.1120, MSC.1/Circ.1436)

(4) Stairways

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

(5) Service spaces (low risk)*

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

** **IACS and IMO interpretations***

Distribution boards may be located behind panels/linings within accommodation spaces including stairway enclosures, without the need to categorize the space, provided no provisions made for storage.

If distribution boards are located in an identifiable space having a deck area of less than 4 m^2,this space may be categorized in (5). (IACS UI SC167, MSC/Circ.1120)

Provision chambers are to be treated as store rooms.

Refrigerated provision chambers are to be category (5) service spaces if thermally insulated with non-combustible materials. (IACS UI SC45)

(6) Machinery spaces of category A

- Spaces as defined in par. 1.2.31 (SOLAS reg. 3.31).

(7) Other machinery spaces*

- Electrical equipment rooms (auto-telephone exchange and air-conditioning duct spaces).
- Spaces as defined in par. 1.2.30 (SOLAS reg. 3.30) excluding machinery spaces of category A.

** **IACS and IMO interpretation***

In cases where urea or sodium hydroxide solution tanks for selective catalytic reduction (SCR) systems, exhaust gas recirculation (EGR) systems or exhaust gas cleaning systems (EGCS) are installed in a space separated from the engine-room, in determining fire integrity of divisions, the solution tank space should be considered as "similar spaces" in the definition of "machinery spaces" in par. 1.2.30 (SOLAS reg. 3.30) and should be categorized as (7): "Other machinery spaces".

The division between the engine-room and the solution tank space should have a fire integrity of at least "A-0" class. (IACS UI SC294, MSC.1/Circ.1616)

(8) Cargo pump-rooms

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

(9) Service spaces (high risk)*

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

** **IACS interpretation***

Provision chambers are to be treated as store rooms.

Refrigerated provision chambers are to be category (9) service spaces if thermally insulated with combustible materials. (IACS UI SC45)

(10) Open decks

- Open deck spaces and enclosed promenades having little or no fire risk. To be considered in this category, enclosed promenades shall have no significant fire risk, meaning that furnishings shall be restricted to deck furniture. In addition, such spaces shall be naturally ventilated by permanent openings. Air spaces (the space outside superstructures and deckhouses). (SOLAS II-2/9.2.4.2.2)

11.6.3.2.3 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 insulation and integrity of a division. (SOLAS II-2/9.2.4.2.3)

11.6.3.2.4 External boundaries which are required in sec. 2.1.1 (SOLAS reg. 11.2) to be of steel or other equivalent material may be pierced for the fitting of windows and sidescuttles provided that there is no requirement for such boundaries of tankers to have "A" class integrity. Similarly, in such boundaries which are not required to have "A" class integrity, doors may be constructed of materials which are to the satisfaction of the Administration. (SOLAS II-2/9.2.4.2.4)

11.6.3.2.5 Exterior boundaries of superstructures* and deckhouses enclosing accommodation and including any overhanging decks which support such accommodation, shall be constructed of steel and insulated to "A-60" standard for the whole of the portions which face the cargo area and on the outward sides for a distance of 3 m from the end boundary facing the cargo area. The distance of 3 m shall be measured horizontally and parallel to the middle line of the ship from the boundary which faces the cargo area at each deck level. In the case of the sides of those superstructures and deckhouses, such insulation shall be carried up to the underside of the deck of the navigation bridge. (SOLAS II-2/9.2.4.2.5)

** **IACS and IMO interpretation***

For the portions which face the cargo area, the "A-60" class insulation should be provided up to the underside of the deck of the navigation bridge. (IACS UI SC174, MSC.1/Circ.1203)

11.6.3.2.6 Skylights to cargo pump-rooms shall be of steel, shall not contain any glass and shall be capable of being closed from outside the pump-room. (SOLAS II-2/9.2.4.2.6)

11.6.3.2.7 Construction and arrangement of saunas* shall comply with sec. 11.1.2.3.4 (SOLAS par. 9.2.2.3.4). (SOLAS II-2/9.2.4.2.7)

** **IMO interpretation***

The space categories mentioned in sec. 11.1.2.3.4 (SOLAS reg. 9.2.2.3.4.1) should be replaced, when applying this regulation, to categories (5), (7) and (10). (MSC/Circ.1120)

11.6.3.3 Protection of cargo space boundaries

In tankers, for the protection of cargo tanks carrying crude oil and petroleum products having a flashpoint not exceeding 60°C, materials readily rendered ineffective by heat shall not be used for valves, fittings, tank opening covers, cargo vent piping, and cargo piping so as to prevent the spread of fire to the cargo. (SOLAS II-2/9.6.3)

Table 9.7
Fire integrity of bulkheads separating adjacent spaces

Spaces		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control stations	(1)	A-0 c)	A-0	A-60	A-0	A-15	A-60	A-15	A-60	A-60	*
Corridors	(2)		C	B-0	B-0 A-0 a)	B-0	A-60	A-0	A-60	A-0	*
Accommodation spaces	(3)			C	B-0 A-0 a)	B-0	A-60	A-0	A-60	A-0	*
Stairways	(4)				B-0 A-0 a)	B-0 A-0 a)	A-60	A-0	A-60	A-0	*

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

Table 9.8
Fire integrity of decks separating adjacent spaces

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

Notes: To be applied to tables 9.7 and 9.8 as appropriate.

a) For clarification as to which applies, see sec. 2.2.3 and 2.2.5 (SOLAS par. 2.3.2 and 2.3.4).
b) Where spaces are of the same numerical category and superscript b appear, a bulkhead or deck of the rating shown in the tables is only required when the adjacent spaces are for a different purpose (e.g. in category (9)). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.
c) Bulkheads separating the wheelhouse, chartroom and radio room from each other may have a "B-0" rating.
d) Bulkheads and decks between cargo pump-rooms and machinery spaces of category A may be penetrated by cargo pump shaft glands and similar gland penetrations, provided that gas tight seals with efficient lubrication or other means of ensuring the permanence of the gas seal are fitted in way of the bulkheads or deck.
e) Fire insulation need not be fitted if the machinery in category (7) if, in the opinion of the Administration, it has little or no fire risk**.

**** *IMO interpretation***

For the definition of machinery spaces having little or no fire risk in footnote "e" see par. 4.2.4.2.2(10) (SOLAS reg. 9.2.2.3.2.2 (10)). (MSC/Circ.1120)

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* 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 should 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.

11.6.4 Fire protection of cargo areas and ship spaces

11.6.4.1 Protection by inert gas systems

11.6.4.1.1 Application

11.6.4.1.1.1 For tankers of 8,000 tonnes deadweight and upwards when carrying cargoes described in par. 11.6.1.1 or 11.6.1.2 (with flashpoint not exceeding 60°C) (SOLAS reg. 1.6.1 or 1.6.2), the protection of the cargo tanks shall be achieved by a fixed inert gas system in accordance with the requirements of sec. 11.6.6 (FSS Code), except that the Administration may accept other equivalent systems or arrangements, as described in sec. 11.6.4.1.3 (SOLAS par. 4.5.5.4). (SOLAS II-2/4.5.5.1.2)

11.6.4.1.1.2 Tankers operating with a cargo tank cleaning procedure using crude oil washing shall be fitted with an inert gas system complying with sec. 11.6.6 (FSS Code) and with fixed tank washing machines. (SOLAS II-2/4.5.5.1.3)

11.6.4.1.1.3 Tankers required to be fitted with inert gas systems shall comply with the following provisions:

.1 double-hull spaces* shall be fitted with suitable connections for the supply of inert gas;

*** *IACS and IMO interpretation***

Double-hull spaces required to be fitted with suitable connections for the supply of inert gas as per this par. *11.6.4.1.1.3.1 (SOLAS reg. II-2/4.5.5.1.4.1) are all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks, except cargo pump-rooms and ballast pump-rooms. (IACS UI SC272, MSC.1/Circ.1555)*

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

.3 where such spaces are not permanently connected to an inert gas distribution system, appropriate means shall be provided to allow connection to the inert gas main. (SOLAS II-2/4.5.5.1.4)

11.6.4.1.2 General requirements for inert gas systems

11.6.4.1.2.1 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. (SOLAS II-2/4.5.5.3.1)

11.6.4.1.2.2 Tankers fitted with a fixed inert gas system shall be provided with a closed ullage system*. (SOLAS II-2/4.5.5.3.2)

*** *IMO interpretation***

"Closed ullage system" means a system which allows cargo measurement without breaking the integrity of the tank. (MSC/Circ.1120)

11.6.4.1.3 Requirements for equivalent inert gas systems

11.6.4.1.3.1 The Administration may, after having given consideration to the ship's arrangement and equipment, accept other fixed installations, in accordance with SOLAS reg. I/5 and par. 11.6.4.1.3.3 (SOLAS par. 5.5.4.3). (SOLAS II-2/4.5.5.4.1)

11.6.4.1.3.2 For tankers of 8,000 tonnes deadweight and upwards but less than 20,000 tonnes deadweight, in lieu of fixed installations as required by par. 11.6.4.1.1.1 (SOLAS par. 4.5.5.1.2), the Administration may accept other equivalent arrangements or means of protection in accordance with SOLAS reg. I/5 and par. 11.6.4.1.3.3 (SOLAS par. 4.5.5.4.3). (SOLAS II-2/4.5.5.4.2)

11.6.4.1.3.3 Equivalent systems or arrangements shall:

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

.2 be so designed as to minimize the risk of ignition from the generation of static electricity by the system itself. (SOLAS II-2/4.5.5.4.3)

11.6.4.2 Inerting, purging and gas-freeing

See sec. 17.6.6 of *Part VI*.

11.6.4.3 Gas measurement and detection

11.6.4.3.1 Portable instrument

Tankers shall be equipped with at least one portable instrument* for measuring oxygen and one for measuring flammable vapour concentrations, together with a sufficient set of spares. Suitable means shall be provided for the calibration** of such instruments. (SOLAS II-2/4.5.7.1)

IACS and IMO interpretations

* *Every oil tanker is to be provided with at least two portable gas detectors capable of measuring flammable vapour concentrations in air (%LEL) and at least two portable O_2 analysers. Alternatively, at least two gas detectors, each capable of measuring both oxygen and flammable vapour concentrations in air (%LEL), are to be provided.*

The requirement of this par. 11.6.4.3.1 (SOLAS Reg. II-2/4.5.7.1) for one portable instrument for measuring oxygen and one for measuring flammable vapour concentrations, and spares for both, is considered as being satisfied when a minimum of two instruments, each capable of measuring both oxygen and flammable vapour concentrations are provided onboard. Alternatively two portable instruments for measuring oxygen and two portable instruments for measuring flammable vapour concentrations could be provided onboard. (IACS UI SC149, MSC.1/Circ.1456)

** *Compliance with the provision "suitable means shall be provided for the calibration of such instruments" with the provision "suitable means shall be provided for the calibration of such instruments" in this par. 11.6.4.3.1 (SOLAS regulation II-2/4.5.7.1), may be achieved by portable atmosphere testing instruments being calibrated on board or ashore in accordance with the manufacturer's instructions.*

For the avoidance of any doubt, the above consideration refers to the calibration of portable instruments for measuring oxygen or flammable vapour concentrations, as required by this par. 11.6.4.3.1 (SOLAS reg. II-2/4.5.7.1), and not to any pre-operational accuracy tests as recommended by the manufacturer. (MSC.1/Circ.1581)

In addition, for tankers fitted with inert gas systems, at least two portable gas detectors are to be capable of measuring concentrations of flammable vapours in inerted atmosphere (% gas by volume). (IACS UR F7)

Each cargo tank shall be appropriately arranged so that the condition of the tank atmosphere can be determined with these portable instruments.

11.6.4.3.2 Arrangements for gas measurement in double hull spaces and double bottom spaces

11.6.4.3.2.1 Suitable portable instruments for measuring oxygen and flammable vapour concentrations in double-hull spaces and double-bottom spaces shall be provided. In selecting these instruments, due attention shall be given to their use in combination with the fixed gas-sampling-line systems referred to in par. 11.6.4.3.2.2 (SOLAS par. 4.5.7.2.2). (SOLAS II-2/4.5.7.2.1)

Construction of the double hull spaces and double-bottom spaces shall be such as to enable measuring oxygen and flammable vapour concentrations in such spaces with portable flammable vapour detectors/ instruments using flexible gas sampling hoses.

11.6.4.3.2.2 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. (SOLAS II-2/4. 5.7.2.2)

11.6.4.3.2.3 The materials of construction and dimensions of gas sampling lines shall be such as to prevent restriction. Where plastic materials are used, they shall be electrically conductive. (SOLAS II-2/4.5.7.2.3)

11.6.4.3.2.4 In combination carriers, (...) an approved fixed gas warning system capable of monitoring flammable vapours shall be provided in cargo pump-rooms, pipe ducts and cofferdams, as referred to in par. 11.6.2.1.4 (SOLAS par. 4.5.1.4), 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. (SOLAS II-2/4.5.4.2)

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

11.6.4.3.3.1 In addition to the requirements in par. 11.6.4.3.1 and 11.6.4.3.2 (SOLAS par. 5.7.1 and 5.7.2), oil tankers of 20 000 tonnes deadweight and above, shall be provided with a fixed hydrocarbon gas detection system complying with sec. 11.6.7 (FSS Code) for measuring hydrocarbon gas concentrations in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks*, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks**. (SOLAS II-2/4.5.7.3.1)

IACS and IMO interpretations

* *Interpretation of terms:*

1. *The term "cargo tanks" in the phrase "spaces adjacent to the cargo tanks" includes slop tanks except those arranged for the storage of oily water only.*
2. *The term "spaces" in the phrase "spaces under the bulkhead deck adjacent to cargo tanks" includes dry compartments such as ballast pump-rooms and bow thruster rooms and any tanks such as freshwater tanks, but excludes fuel oil tanks.*
3. *The term "adjacent" in the phrase "adjacent to the cargo tanks" includes ballast tanks, void spaces, other tanks or compartments located below the bulkhead deck located adjacent to cargo tanks and includes any spaces or tanks located below the bulkhead deck which form a cruciform (corner to corner) contact with the cargo tanks. (IACS UI SC268, MSC.1/Circ.1527)*

** *Recommendation on hydrocarbon gas detection system:*

Taking into account that it is assumed that the intention of the requirement is to cover ballast tanks and similar spaces, as well as void spaces and dry compartments; and that gas detection in fuel tanks is considered to be impracticable due to the nature of e.g. heated fuel oil vapour and potential for clogging of small gas sampling lines:

1. *it is not recommended to apply these requirements to fuel tanks located adjacent to cargo tanks;*
2. *it is recommended to apply these requirements to ballast pump rooms, bow thruster rooms etc. located under the bulkhead deck adjacent to cargo or slop tanks***; and*

3. *it is recommended to apply these requirements to freshwater tanks located under the bulkhead deck adjacent to cargo or slop tanks****

*** *excluding slop tanks used solely for the retention of oily water. (IACS REC. 123, par. 3.1)*

11.6.4.3.3.2 Oil tankers provided with constant operative inerting systems (COIS) for such spaces need not be equipped with fixed hydrocarbon gas detection equipment – see sec. 11.6.6.5. (SOLAS II-2/4.5.7.3.2)

11.6.4.3.3.3 Notwithstanding the above, cargo pump-rooms subject to the provisions of sec.11.6.4.7.3 (measures to prevent explosions in cargo pump rooms) (SOLAS par. 5.10) need not comply with the requirements of this par. 11.6.4.3.3.1. (SOLAS II-2/4.5.7.3.3)

11.6.4.4 Air supply to double hull and double bottom spaces

Double hull and double bottom spaces shall be fitted with suitable connections for the supply of air. (SOLAS II-2/4.5.8)

11.6.4.5 Protection of cargo area

Drip pans for collecting cargo residues in cargo lines and hoses* shall be provided in the area of pipe and hose connections under the manifold area. Cargo hoses and tank washing hoses shall have electrical continuity over their entire lengths including couplings and flanges (except shore connections) and shall be earthed for removal of electrostatic charges. (SOLAS II-2/4.5.9)

11.6.4.6 Protection of cargo tanks by fixed deck foam systems*

**** IMO interpretation***

Interpretation concerning enclosed pipe trunk:

Where an enclosed pipe trunk is situated within the cargo tanks deck area, the pipe trunk:

.1 should be protected by a fixed fire-extinguishing system in accordance with sub-chapter 11.6.4.7.1 (SOLAS reg. II-2/10.9). The extinguishing system should 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 deck foam system required by this sec. 11.6.4.6 (SOLAS reg. II-2/10.8);

.4 should be adequately ventilated and protected in accordance with par. 11.6.4.7.3.2 and 11.6.4.7.3.3 (SOLAS reg. II-2/4.5.10.1.2 and II-2/4.5.10.1.3); and

.5 should 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 should be regarded as a cargo pump room. (MSC.1/Circ.1276/Rev.1)

11.6.4.6.1 For tankers of 20,000 tonnes deadweight and upwards, a fixed deck foam system shall be provided in accordance with the requirements of sec. 11.6.5 (FSS Code), except that, in lieu of the above, the Administration, after having given consideration to the ship's arrangement and equipment, may accept other fixed installations if they afford protection equivalent to the above, in accordance with SOLAS reg. I/5. The requirements for alternative fixed installations shall comply with the requirements in par. 11.6.4.6.2 (SOLAS par. 8.1.2). (SOLAS II-2/10.8.1.1)

11.6.4.6.2 In accordance with par. 11.6.4.6.1 (SOLAS par. 8.1.1), where the Administration accepts an equivalent fixed installation in lieu of the fixed deck foam system, the installation shall:

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

.2 be capable of combating fires in ruptured tanks. (SOLAS II-2/10.8.1.2)

11.6.4.6.3 Tankers of less than 20,000 tonnes deadweight shall be provided with a deck foam system complying with the requirements of sec. 11.6.5 (FSS Code). (SOLAS II-2/10.8.1.3)

11.6.4.6.4 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^2 of the surface area.

11.6.4.6.5 Additional fire safety measures for tankers of less than 500 gross tonnage – see sec. 9.20.

11.6.4.7 Protection of cargo pump-rooms

11.6.4.7.1 Fixed fire-extinguishing systems

Each cargo pump-room shall be provided with one of the following fixed fire-extinguishing systems operated from a readily accessible position outside the pump-room. Cargo pump-rooms shall be provided with a system suitable for machinery spaces of category A. (SOLAS II-2/10.9.1)

11.6.4.7.1.1 A carbon dioxide system complying with the provisions of sec. 3.6.2 (FSS Code) and with the following:

.1 the alarms* giving audible warning of the release of fire-extinguishing medium shall be safe for use in a flammable cargo vapour/air mixture; and

.2 a notice shall be exhibited at the controls stating that due to the electrostatic ignition hazard, the system is to be used only for fire extinguishing and not for inerting purposes. (SOLAS II-2/10.9.1.1)

Quantity of CO_2 should be sufficient to give a minimum volume of free gas corresponding to 45% of the gross volume of the protected space.

Where audible alarms are fitted to warn of the release of fire extinguishing medium into pump rooms, they may be of the pneumatic type or electric type.

(a) Pneumatically operated alarms

In cases where the periodic testing of such alarms is required, CO_2 operated alarms should not be used owing to the possibility of the generation of static electricity in the CO_2 cloud. Air operated alarms may be used provided the air supply is clean and dry.

(b) Electrically operated alarms

When electrically operated alarms are used, the arrangements are to be such that the electric actuating mechanism is located outside the pump room except where the alarms are certified intrinsically safe.

It was further agreed that the use of CO_2 operated alarms should be discouraged. (IACS UR F5)

11.6.4.7.1.2 A high-expansion foam system complying with the provisions of sec. 3.5.3 (FSS Code), provided that the foam concentrate supply is suitable for extinguishing fires involving the cargoes carried. (SOLAS II-2/10.9.1.2)

11.6.4.7.1.3 A fixed pressure water-spraying system complying with the provisions of sec. 3.4.3 (FSS Code). (SOLAS II-2/10.9.1.3)

11.6.4.7.2 Quantity of fire-extinguishing medium

Where the extinguishing medium used in the cargo pump-room system is also used in systems serving other spaces, the quantity of medium provided or its delivery rate need not be more than the maximum required for the largest compartment. (SOLAS II-2/10.9.2)

11.6.4.7.3 Additional measures to prevent explosions in cargo pump rooms

In tankers:

.1 cargo pumps, ballast pumps and stripping pumps, installed in cargo pump-rooms and driven by shafts passing through pump-room bulkheads shall be fitted with temperature sensing devices* for bulkhead shaft glands, bearings and pump casings. A continuous audible and visual alarm signal shall be automatically effected in the cargo control room or the pump control station;

Where drive shafts pass through pump room bulkhead or deck plating, gastight glands are to be fitted. The glands are to be efficiently lubricated from outside the pumproom. The seal parts of the glands are to be of material that will not initiate sparks. The glands are to be constructed and fitted in accordance with the relative rules for fittings attached to watertight bulkheads, and if a bellows piece is incorporated in the design, it should be pressure tested before fitting. (IACS UR F13)

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* *Guidelines for the temperature monitoring system* – see MSC.1/Circ.1321, Part IV, Chapter 2.

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

**** IMO interpretation***

Where the lighting in cargo pump-rooms can be commonly used as the emergency lighting, this lighting should be interlocked with the ventilation systems. However, this interlock should not prevent operation of the emergency lighting in case of the loss of the main source of electrical power. (MSC/Circ.1120)

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

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**** IACS and IMO interpretation***

Sequential sampling is acceptable as long as it is dedicated for the pump room only, including exhaust ducts, and the sampling time is reasonably short.

Detection positions are the zones where air circulation is reduced (e.g., recessed corners). (IACS UI SC172, MSC/Circ.1120)

Guidelines for the gas detection system – see MSC.1/Circ.1321, Part IV, Chapter 3.

See IACS REC. 123: *Recommendation based on IMO instruments - MSC.1/Circ.1370 "Guidelines for the design, construction and testing of fixed hydrocarbon gas detection systems".*

.4 all pump-rooms shall be provided with bilge level monitoring devices together with appropriately located alarms*. (SOLAS II-2/4.5.10)

**** IMO interpretation***

Bilge high-level alarms are acceptable as an alternative means for the level monitoring devices. (MSC/Circ.1120)

11.6.4.7.4 Fire detection and fire alarm system

Cargo pump-room shall be provided with a fixed fire detection and alarm system using smoke detectors, approved for use in gas hazardous atmosphere, comply with relevant requirements of sub-chapter 4.1 (FSS Code Ch. 9). The system shall be monitored from the cargo control room (if provided) and from the wheelhouse.

11.6.4.7.5 Portable fire extinguishers

Cargo-pump room shall be provided with at least two (2) portable extinguishers located in readily accessible positions in the lower part of the room. One portable extinguisher shall be provided adjacent to the entrance of the room.

The portable extinguishers shall be approved 12 kg powder or 9 l foam portable extinguishers.

11.6.4.8 Water fire main systems

11.6.4.8.1 Isolation valves

11.6.4.8.1.1 In tankers, isolation valves shall be fitted in the fire main at poop front in a protected position* and on the tank deck at intervals of not more than 40 m to preserve the integrity of the fire main system in case of fire or explosion. (SOLAS II-2/10.2.1.4.4)

*** *IMO interpretations***

The complete interpretation of the phrase "the isolation valves shall be fitted in the fire main at the poop front in a protected position" would be that the valve should be located within an accommodation space, service spaces or control station. However, the valve may be located on the open deck aft of the cargo area provided that the valve is located:

.1 at least 5 m aft of the aft end of the aftermost cargo tank; or

.2 if the above .1 is not practical, within 5 m aft of the aft end of the aftermost cargo tank provided the valve is protected by a permanent steel obstruction. (MSC.1/Circ.1456, MSC.1/Circ.1492)

An information plate shall be provided at each isolation valve to indicate that the valve shall always be kept open during the ship's normal operation.

The location of each isolation valve on the water fire main should be indicated with the symbol used on *Fire Control Plan*.

11.6.4.8.1.2 It is recommended, that the ship be equipped with a fire main on open deck arranged as a ring main to the port and starboard side. It should be possible to supply water from one side, when the pipeline on other side, after damage, is cut off by isolation valves.

11.6.4.8.2 Water spray protection for lifeboats

It is recommended, that lifeboats which are not shielded by steel bulkheads from the cargo areas should be provided with a water spray system. The system may be supplied from the fire main and should be capable of quick release from the wheelhouse.

11.6.4.8.3 Fire hoses and nozzles

Aluminium alloys may be used for fire hose couplings and nozzles, except in open deck areas of oil tankers and chemical tankers. (SOLAS II-2/10.2.3, IACS UI SC146)

11.6.4.9 Fire-fighter' s outfits

In addition to requirements of par. 6.7.2.1, in tankers, two fire-fighter's outfits, complying with sec. 5.4, shall be provided. (SOLAS II-2/10.10.2.3)

11.6.4.10 Aluminium coatings on board oil tankers

The use of aluminium coatings containing greater than 10 percent aluminium by weight in the dry film is prohibited in cargo tanks, cargo tank deck area, pump rooms, cofferdams or any other area where cargo vapour may accumulate.

Aluminised pipes may be permitted in ballast tanks, in inerted cargo tanks and, provided the pipes are protected from accidental impact, in hazardous areas on open deck. (IACS UR F2)

11.6.4.11 Temperature of steam and heating media within the cargo area

On oil tankers, the steam and heating media temperature within the cargo area is not to exceed 220°C. (IACS UR F24)

11.6.5 Fixed deck foam systems

11.6.5.1 General

11.6.5.1.1 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 has been ruptured. (FSS Code, Ch. 14/2.1.1)

11.6.5.1.2 The deck foam system shall be capable of simple and rapid operation*. (FSS Code, Ch. 14/2.1.2)

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* ***IACS interpretation***

The major equipment such as the foam concentrate tank and the pumps may be located in the engine room. The controls of the system are to be located in accordance with par.11.6.5.2.3.1 (FSS Code, Ch. 14, 2.3.1). (IACS UI SC150)

11.6.5.1.3 The deck foam system and the water fire main system may be supplied from the common water line. However, 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*. Where the deck foam system is supplied by a common line from the fire main, additional foam concentrate shall be provided for operation of two nozzles for the same period of time required for the foam system. The simultaneous use of the minimum required jets of water shall be possible on deck over the full length of the ship, in the accommodation, service spaces, control stations and machinery spaces. (FSS Code, Ch. 14/2.1.3)

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* ***IMO interpretation***

A common line for fire main and deck foam line can only be accepted provided 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. (MSC/Circ.1120)

11.6.5.1.4 Generally, the deck foam systems shall be designed for low-expansion foam (see sec. 3.5.4); however, after appropriate tests, medium-expansion foam* may be permitted.

Where medium expansion foam concentrate is used (see par. 11.6.5.2.2.1), it shall be approved based on the guidelines developed by IMO*.

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* Refer to *Guidelines for performance and testing criteria and surveys of medium-expansion foam concentrate for fixed fire-extinguishing systems* - MSC/Circ.798.

11.6.5.2 Component requirements

11.6.5.2.1 Foam solution and foam concentrate

11.6.5.2.1.1 For tankers carrying:

.1 crude oil or petroleum products having a flashpoint not exceeding 60°C (closed cup), as determined by an approved flashpoint apparatus, and a Reid vapour pressure which is below atmospheric pressure or other liquid products having a similar fire hazard, including cargoes in chapter 18 of the IBC Code, having a flashpoint not exceeding 60°C (closed cup) for which a regular foam fire-fighting system is effective (refer to SOLAS reg. II-2/1.6.1 and 10.8); or; or

.2 petroleum products with a flashpoint exceeding 60°C (closed cup), as determined by an approved flashpoint apparatus (refer to SOLAS reg. II-2/1.6.4); or

.3 IBC Code chapter 17 products with a flashpoint exceeding 60°C (closed cup) determined by an approved flashpoint apparatus (refer to par. 11.1.3 IBC Code and SOLAS reg. II-2/1.6.4),

the rate of supply of foam solution shall be not less than the greatest of the following:

.4 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;

.5 6 *l*/min per square metre of the horizontal sectional area of the single tank having the largest such area; or

.6 3 *l*/min per square metre of the area protected by the largest monitor, such area being entirely forward of the monitor, but in no case should the output of any monitor be less than 1,250 *l*/min. (FSS Code, Ch. 14/2.2.1.1)

11.6.5.2.1.2 For tankers carrying chemicals in bulk listed in chapter 17 of the IBC Code having a flashpoint not exceeding 60°C (closed cup), the rate of supply of foam solution shall be as required by IBC Code. (FSS Code, Ch. 14/2.2.1.2)

11.6.5.2.1.3 Sufficient foam concentrate shall be supplied to ensure at least 20 min of foam generation in tankers fitted with an inert gas installation or 30 min of foam generation in tankers not fitted with an inert gas installation or not required to use an inert gas system. (FSS Code, Ch. 14/2.2.1.3)

If the deck foam system and the water fire main system are to be supplied from the common water line, this period of time shall take into account the additional amount of the foam concentrate, see par. 11.6.5.1.3.

11.6.5.2.1.4 The foam concentrate supplied on board shall be approved by the Administration* for the cargoes intended to be carried. Type B foam concentrates shall be supplied for the protection of crude oil, petroleum products and non-polar solvent cargoes. Type A foam concentrates shall be supplied for polar solvent cargoes, as listed in the table of chapter 17 of the IBC Code. 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 cargoes for which foam is not effective or is incompatible, additional arrangements to the satisfaction of the Administration shall be provided. (FSS Code, Ch. 14/2.2.1.4)

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* Refer to the *Guidelines for performance and testing criteria and surveys of foam concentrates for fixed fire-extinguishing systems* (MSC.1/Circ.1312/Corr.1).

11.6.5.2.1.5 Liquid cargoes with a flashpoint not exceeding 60°C for which a regular foam fire-fighting system is not effective shall comply with the provisions of SOLAS reg. II-2/1.6.2.1. (FSS Code, Ch. 14/2.2.1.5)

11.6.5.2.2 Monitors and foam applicators

11.6.5.2.2.1 Foam from the fixed foam system shall be supplied by means of monitors and foam applicators. Prototype tests of the monitors and foam applicators shall be performed to ensure the foam expansion and drainage time of the foam produced does not differ more than ± 10 per cent of that determined in par. 11.6.5.2.1.4 (FSS Code Ch.14/2.2.1.4). When medium expansion ratio foam (expansion ratio between 200 to 21) is employed, the application rate of the foam and the capacity of a monitor installation shall be to the satisfaction of the Administration. At least 50 per cent of the foam solution supply rate required shall be delivered from each monitor. On tankers of less than 4,000 tonnes deadweight the Administration may not require installation of monitors but only applicators. However, in such a case the capacity of each applicator shall be at least 25 per cent of the foam solution supply rate required. (FSS Code, Ch. 14/2.2.2.1)

11.6.5.2.2.2 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. (FSS Code, Ch. 14/2.2.2.2)

11.6.5.2.3 Installation requirements

11.6.5.2.3.1 Main control station

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 fire in the areas protected. (FSS Code, Ch. 14/2.3.1.1)

The location of the main control station should be indicated with the symbol used on *Fire Control Plan*.

11.6.5.2.3.2 Monitors

11.6.5.2.3.2.1 The number and position of monitors shall be such as to comply with par. 11.6.5.1.1 (FSS Code Ch.14/2.1.1). (FSS Code, Ch. 14/2.3.2.1)

11.6.5.2.3.2.2 The distance from the monitor to the farthest extremity of the protected area forward of that monitor shall not be more than 75 per cent of the monitor throw in still air conditions. (FSS Code, Ch. 14/2.3.2.2)

11.6.5.2.3.2.3 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. The monitors* and hose connections shall be aft of any cargo tanks, but may be located in the cargo area above pump-rooms, cofferdams, ballast tanks and void spaces adjacent to cargo tanks if capable of protecting the deck below and aft of each other. On tankers of less than 4,000 tonnes deadweight a hose connection for a foam applicator shall be situated both port and starboard at the front of the poop or accommodation spaces facing the cargo tanks deck. (FSS Code, Ch. 14/2.3.2.3)

*** *IACS and IMO interpretation***

The port and starboard monitors required by this paragraph may also be located in the cargo area above oil bunker tanks adjacent to cargo tanks if capable of protecting the deck below and aft of each other. (IACS UI SC169, MSC.1/Circ.1491)

11.6.5.2.3.3 Foam applicators

11.6.5.2.3.3.1 At least four foam applicators shall be provided on all tankers. The number and disposition of foam main outlets shall be such that foam from at least two applicators can be directed on to any part of the cargo tanks deck area. (FSS Code, Ch. 14/2.3.3.1)

11.6.5.2.3.3.2 Applicators shall be provided to ensure flexibility of action during fire-fighting operations and to cover areas screened from the monitors. (FSS Code, Ch. 14/2.3.3.2)

11.6.5.2.3.4 Isolation valves

Valves shall be provided in the foam main, and in the fire main when this is an integral part of the deck foam system, immediately forward of any monitor position to isolate damaged sections of those mains. (FSS Code, Ch. 14/2.3.4.1)
Location of the isolation valves should be marked with the symbol used in the *Fire Control Plan*.

11.6.5.3 Foam concentrate tank

Means shall be provided for the crew to check the amount of foam concentrate in the tank and take samples of the foam concentrate to periodically check its quality. The minimum level/ required amount of foam concentrate shall be marked on the level indicator of the tank.

Location of the foam concentrate tanks should be marked with the symbol used in the *Fire Control Plan*.

11.6.5.4 Tests of the system after installation on board

11.6.5.4.1 After fitting on board, all piping of the system shall be pressure tested with the test pressure at least 1.25 working pressure.

11.6.5.4.2 After installation on board, the system is subject to functional tests in accordance with the agreed acceptance and test program.

11.6.6 Inert gas systems

11.6.6.1 Definitions

For the purposes of this sec. 11.6.6, the following definitions apply:

.1 ***Cargo tanks*** means those cargo tanks, including slop tanks, which carry cargoes, or cargo residues, having a flashpoint not exceeding 60°C. (FSS Code, Ch. 15/2.1.1)

.2 ***Inert gas system*** includes inert gas systems using flue gas, inert gas generators, and nitrogen generators and means the inert gas plant and inert gas distribution together with means for preventing backflow of cargo gases to machinery spaces, fixed and portable measuring instruments and control devices. (FSS Code, Ch. 15/2.1.2)

.3 ***Gas-safe space*** is a space in which the entry of gases would produce hazards with regard to flammability or toxicity. (FSS Code, Ch. 15/2.1.3)

.4 ***Gas-free*** is a condition in a tank where the content of hydrocarbon or other flammable vapour is less than 1% of the lower flammable limit (LFL), the oxygen content is at least 21%, and no toxic gases are present*. (FSS Code, Ch. 15/2.1.4)

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* Refer to the *Revised recommendations for entering enclosed spaces aboard ships* - res. A.1050(27).

11.6.6.2 Requirements for all systems

11.6.6.2.1 General

11.6.6.2.1.1 All types of inert gas systems are to comply with the following:

.1 Plans in diagrammatic form are to be submitted for appraisal and should include the following:
- details and arrangement of the inert gas generating plant including all control and monitoring devices;
- arrangement of the piping system for distribution of the inert gas.

.2 An automatic control capable of producing suitable inert gas under all service conditions is to be fitted. (IACS UR F20.1.1)

11.6.6.2.1.2 An inert gas system complying with the applicable requirements of this sec. 11.6.6 (Ch. 15 of the FSS Code), is to be fitted on tankers to which SOLAS regulation II-2/4.5.5.1 applies. (…) The inert gas system is to be operated in accordance with SOLAS regulation II-2/16.3.3. In applying SOLAS regulation II-2/16.3.3.2, paragraph 2.2.1.2.4 of Ch. 15 of the FSS Code is to be complied with. (IACS UR F20.2.1)

11.6.6.2.1.3 The inert gas system referred to in this *Part V* (SOLAS chapter II-2) shall be designed, constructed and tested to the satisfaction of the Administration*. It shall be designed to be capable of rendering and maintaining the atmosphere of the relevant cargo tanks non-flammable**. (FSS Code, Ch. 15/2.2.1.1)

* Refer to *Revised Guidelines for Inert Gas Systems,* specified in MSC/Circ.353 as amended by MSC/Circ.387, as well as MSC/Circ.450/Rev.1

** Refer 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, as amended by MSC/Circ.1009 and MSC.1/Circ.1324) and the *Revised factors to be taken into consideration when designing cargo tank venting and gas-freeing arrangements* (MSC/Circ.731).

11.6.6.2.1.4 The system shall be capable of:

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

.2 eliminating the need for air to enter a tank during normal operations except when it is necessary for such a tank to be gas-free;

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

.4 delivering inert gas to the cargo tanks at a rate of at least 125% of the maximum rate of discharge capacity of the ship expressed as a volume. For chemical tankers and chemical/product tankers, the Administration may accept inert gas systems having a lower delivery capacity provided that the maximum rate of discharge of cargoes from cargo tanks being protected by the system is restricted to not more than 80% of the inert gas capacity; and

.5 delivering inert gas with an oxygen content of not more than 5% by volume to the cargo tanks at any required rate of flow. (FSS Code, Ch. 15/2.2.1.2)

11.6.6.2.1.5 Materials used in inert gas systems shall be suitable for their intended purpose. In particular, those components which may be subjected to corrosive action of the gases and/or liquids are to be either constructed of corrosion-resistant material or lined with rubber, glass fibre epoxy resin or other equivalent coating material. (FSS Code, Ch. 15/2.2.1.3)

11.6.6.2.1.6 The inert gas supply may be:

.1 treated flue gas from main or auxiliary boilers, or
.2 gas from an oil or gas-fired gas generator, or
.3 gas from nitrogen generators.

The Administration may accept systems using inert gases from one or more separate gas generators or other sources or any combination thereof, provided that an equivalent level of safety is achieved. Such systems shall, as far as practicable, comply with the requirements of this sec. 11.6.6 (chapter). Systems using stored carbon dioxide shall not be permitted unless the Administration is satisfied that the risk of ignition from generation of static electricity by the system itself is minimized. (FSS Code, Ch. 15/2.2.1.4)

11.6.6.2.2 Safety measures

11.6.6.2.2.1 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. (FSS Code, Ch. 15/2.2.2.1)

11.6.6.2.2.2 Automatic shutdown* of the inert gas system and its components parts shall be arranged on predetermined limits being reached, taking into account the provisions of sec. 11.6.6.2.4, 11.6.6.3.2 and 11.6.6.4.2 (FSS Code, par. 2.2.4, 2.3.2 and 2.4.2). (FSS Code, Ch. 15/2.2.2.2)

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* ***IACS and IMO interpretation***

The automatic shut-down of the inert gas system and its components shall involve the following:

1 Shut-down of fans and closing of regulating valve for the following:

- *High water level in scrubber (not applicable for N_2)*
- *Low pressure/flow to scrubber (not applicable for N_2)*
- *High-high temperature of inert gas supply*

2 Closing of regulating valve in the event of:

- *High oxygen content (in excess of 5% by volume)*
- *Failure of blowers/fans or N_2 compressors*

3 Activation of double-block and bleed arrangement upon (for ships with double block and bleed replacing water seal):

- *Loss of inert gas supply*
- *Loss of power. (IACS UI SC284, MSC.1/Circ.1582, Rev.1)*

11.6.6.2.2.3 Suitable shutoff arrangements shall be provided on the discharge outlet of each generator plant. (FSS Code, Ch. 15/2.2.2.3)

11.6.6.2.2.4 The system shall be designed to ensure that if the oxygen content exceeds 5% by volume, the inert gas shall be automatically vented to atmosphere. (FSS Code, Ch. 15/2.2.2.4)

11.6.6.2.2.5 Arrangements shall be provided to enable the functioning of the inert gas plant to be stabilized before commencing cargo discharge. If blowers are to be used for gas-freeing, their air inlets shall be provided with blanking arrangements. (FSS Code, Ch. 15/2.2.2.5)

11.6.6.2.2.6 Where a double block and bleed valve is installed, the system shall ensure upon of loss of power, the block valves are automatically closed and the bleed valve is automatically open. (FSS Code, Ch. 15/2.2.2.6)

11.6.6.2.3 System components

11.6.6.2.3.1 Non-return devices

11.6.6.2.3.1.1 At least two non-return devices shall be fitted in order to prevent the return of vapour and liquid to the inert gas plant, or to any gas-safe spaces. (FSS Code, Ch. 15/2.2.3.1.1)

11.6.6.2.3.1.2 The first non-return device shall be a deck seal of the wet, semi-wet, or dry type or a double-block and bleed arrangement. Two shut-off valves in series with a venting valve in between, may be accepted provided:

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

.2 alarm for faulty operation of the valves is provided, e.g. the operation status of "blower stop" and "supply valve(s) open" is an alarm condition. (FSS Code, Ch. 15/2.2.3.1.2)

11.6.6.2.3.1.3 The second non-return device shall be a non-return valve or equivalent capable of preventing the return of vapours and liquids and fitted between the deck water seal (or equivalent device) and the first connection from the inert gas main to a cargo tank. It 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 between the non-return valve and the first connection to the cargo tanks to isolate the deck water seal, or equivalent device, from the inert gas main to the cargo tanks. (FSS Code, Ch. 15/2.2.3.1.3)

11.6.6.2.3.1.4 A water seal, if fitted, shall be capable of being supplied by two separate pumps, each of which shall be capable of maintaining an adequate supply at all times. The audible and visual alarm on the low level of water in the water seal shall operate at all times. (FSS Code, Ch. 15/2.2.3.1.4)

11.6.6.2.3.1.5 The arrangement of the water seal, or equivalent devices, and its associated fittings shall be such that it will prevent backflow of vapours and liquids and will ensure the proper functioning of the seal under operating conditions. (FSS Code, Ch. 15/2.2.3.1.5)

11.6.6.2.3.1.6 Provision shall be made to ensure that the water seal is protected against freezing, in such a way that the integrity of seal is not impaired by overheating. (FSS Code, Ch. 15/2.2.3.1.6)

11.6.6.2.3.1.7 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. Means shall be provided to prevent such loops from being emptied by vacuum. (FSS Code, Ch. 15/2.2.3.1.7)

11.6.6.2.3.1.8 Any water seal, or equivalent device, and loop arrangements shall be capable of preventing return of vapours and liquids to an inert gas plant at a pressure equal to the test pressure of the cargo tanks. (FSS Code, Ch. 15/2.2.3.1.8)

11.6.6.2.3.1.9 The non-return devices shall be located in the cargo area on deck. (FSS Code, Ch. 15/2.2.3.1.9)

11.6.6.2.3.2 Inert gas lines

11.6.6.2.3.2.1 The inert gas main may be divided into two or more branches downstream of the non-return devices required by par. 11.6.6.2.3.1 (FSS Code par. 2.2.3.1). (FSS Code, Ch. 15/2.2.3.2.1)

11.6.6.2.3.2.2 The inert gas main shall be fitted with branch piping leading to the cargo tank. Branch piping for inert gas shall be fitted with either stop valves or equivalent means of control for isolating each tank. Where stop valves are fitted, they shall be provided with locking arrangements. The control system shall provide unambiguous information of the operational status of such valves* to at least the control panel required in sec. 11.6.6.2.4 (FSS Code par. 2.2.4). (FSS Code, Ch. 15/2.2.3.2.2)

*** *IACS and IMO interpretation***

Unambiguous information regarding the operational status of stop valves in branch piping leading from the inert gas main to cargo tanks means position indicators providing open/intermediate/closed status information in the control panel required in sec. 1.6.6.2.4 (FSS Code par. 2.2.4). Limit switches should be used to positively indicate both open and closed position. Intermediate position status shall be indicated when the valve is in neither open nor closed position. (IACS IU SC285, MSC.1/Circ.1582/Rev.1)

11.6.6.2.3.2.3 Each cargo tank not being inerted shall be capable of being separated from the inert gas main by:

.1 removing spool-pieces, valves or other pipe sections, and blanking the pipe ends; or

.2 arrangement of two spectacle flanges in series with provisions for detecting leakage into the pipe between the two spectacle flanges; or

.3 equivalent arrangements to the satisfaction of the Administration, providing at least the same level of protection. (FSS Code, Ch. 15/2.2.3.2.3)

11.6.6.2.3.2.4 Means shall be provided to protect cargo tanks against the effect of overpressure or vacuum caused by thermal variations and/or cargo operations when the cargo tanks are isolated from the inert gas mains. (FSS Code, Ch. 15/2.2.3.2.4)

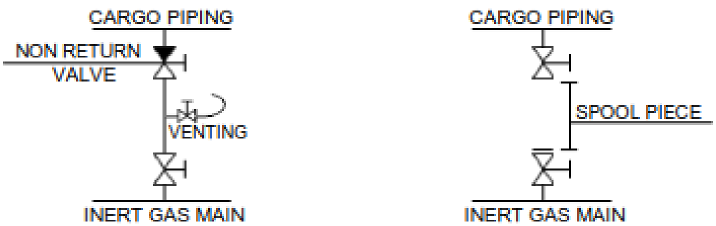
11.6.6.2.3.2.5 Piping systems shall be so designed as to prevent the accumulation of cargo or water in the pipelines under all normal conditions. (FSS Code, Ch. 15/2.2.3.2.5)

11.6.6.2.3.2.6 Arrangements shall be provided to enable the inert gas main to be connected to an external supply of inert gas. The arrangements shall consist of a 250 mm nominal pipe size bolted flange, isolated from the inert gas main by a valve and located downstream of the non-return valve. The design of the flange should conform to the appropriate class in the standards adopted for the design of other external connections in the ship's cargo piping system. (FSS Code, Ch. 15/2.2.3.2.6)

11.6.6.2.3.2.7 If a connection is fitted between the inert gas 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 shutoff valves with an arrangement to vent the space between the valves in a safe manner or an arrangement consisting of a spool-piece with associated blanks*. (FSS Code, Ch. 15/2.2.3.2.7)

*** *IACS interpretation***

As a guide, the effective isolation required by this regulation may be achieved by the two arrangements shown in the following sketches. (IACS UI SC62)



11.6.6.2.3.2.8 The valve separating the inert gas main from the cargo main and which is on the cargo main side shall be a non-return valve with a positive means of closure*. (FSS Code, Ch. 15/2.2.3.2.8)

Note:
* For interpretation – see par. 11.6.6.2.3.2.7 above. (IACS UI SC62)

11.6.6.2.3.2.9 Inert gas piping systems shall not pass through accommodation, service and control station spaces. (FSS Code, Ch. 15/2.2.3.2.9)

11.6.6.2.3.2.10 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 except as provided for in the relevant section of the guidelines developed by Organization*. (FSS Code, Ch. 15/2.2.3.2.10)

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* Refer to the *Revised Guidelines for inert gas systems* (MSC/Circ.353), as amended by MSC/Circ.387.

11.6.6.2.4 Indicators and alarms

11.6.6.2.4.1 The operation status* of the inert gas system shall be indicated in a control panel. (FSS Code, Ch. 15/2.2.4.1)

**** IACS and IMO interpretation***

The operational status of the inert gas system shall be based on indication that inert gas is being supplied downstream of the gas regulating valve and on the pressure or flow of the inert gas mains downstream of the non-return devices. However, the operational status of the IG system as required by this par.11.6.6.2.4.1 (FSS Code 15.2.2.4.1) shall not be considered to require additional indicators and alarms other than those specified in sub-chapters 4.6.2.4, 4.6.3.2 and 6.4.2 (FSS Code 15.2.2.4 and 15.2.3.2 or 15.2.4.2), as appropriate. (IACS UI SC286, MSC.1/Circ.1582, Rev.1)

11.6.6.2.4.2 Instrumentation shall be fitted for continuously indicating and permanently recording, when inert gas is being supplied:

.1 the pressure of the inert gas mains downstream of the non-return devices; and
.2 the oxygen content of the inert gas. (FSS Code, Ch. 15/2.2.4.2)

11.6.6.2.4.3 The indicating and recording devices shall be placed in the cargo control room where provided. But where no cargo control room is provided, they shall be placed in a position easily accessible to the officer in charge of cargo operations. (FSS Code, Ch. 15/2.2.4.3)

11.6.6.2.4.4 In addition, meters shall be fitted:

.1 in the navigating bridge to indicate at all times the pressure referred to in par. 11.6.6.2.4.2.1 (FFS Code, par. 2.2.4.2.1) and the pressure in the slop tanks of combination carriers, whenever those tanks are isolated from the inert gas main; and
.2 in the machinery control room or in the machinery space to indicate the oxygen content referred to in par. 11.6.6.2.4.2.2 (FSS Code, par. 2.2.4.2.2). (FSS Code, Ch. 15/2.2.4.4)

11.6.6.2.4.5 Audible and visual alarms

11.6.6.2.4.5.1 Audible and visual alarms shall be provided, based on the system designed, to indicate:

.1 oxygen content in excess of 5% by volume;
.2 failure of the power supply to the indicating devices as referred to in par. 11.6.6.2.4.2 (FSS Code, par. 2.2.4.2);

.3 gas pressure less than 100 mm water gauge. The alarm arrangement shall be such as to ensure that the pressure in slop tanks in combination carriers can be monitored at all times;
.4 high-gas pressure; and
.5 failure of the power supply to the automatic control system. (FSS Code, Ch. 15/2.2.4.5.1)

11.6.6.2.4.5.2 The alarms required in par. 11.6.6.2.4.5.1.1, .3 and .5 (FSS Code, par. 2.2.4.5.1.1, 2.2.4.5.1.3 and 2.2.4.5.1.5) 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. (FSS Code, Ch. 15/2.2.4.5.2)

11.6.6.2.4.5.3 An audible alarm system independent* of that required in par. 11.6.6.2.4.5.1.3 (FSS Code par. 2.2.4.5.1.3) or automatic shutdown of cargo pumps shall be provided to operate on predetermined limits of low pressure in the inert gas main being reached. (FSS Code, Ch. 15/2.2.4.5.3)

**** IACS and IMO interpretation***

The term "independent alarm system" as specified in sec.11.6.6.2.4.5 (FSS Code 15.2.2.4.5) means that a second pressure sensor, independent of the sensor serving the alarms for low pressure, high pressure and pressure indication/recorder shall be provided. Notwithstanding the above, a common programmable logic controller (PLC) is, however, accepted for the alarms in the control system. The independent sensor is not required if the system is arranged for the shutdown of cargo pumps. If a system for shutdown of cargo pumps is arranged, an automatic system shutting down all cargo pumps shall be provided. The shutdown shall be alarmed at the control station. The shutdown shall not prevent the operation of ballast pumps or pumps used for bilge drainage of a cargo pump room. (IACS UI SC287, MSC.1/Circ.1582, Rev.1)

11.6.6.2.4.5.4 Two oxygen sensors shall be positioned at appropriate locations in the space or spaces containing the inert gas system. If the oxygen level falls below 19%, these sensors shall trigger alarms, which shall be both visible and audible inside and outside the space or spaces and shall be placed in such a position that they are immediately received by responsible members of the crew. (FSS Code, Ch. 15/2.2.4.5.4)

11.6.6.2.5 Instruction manuals

Detailed instruction manuals shall be provided on board, covering the operations, safety and maintenance requirements and occupational health hazards relevant to the inert gas system and its application to the cargo tank system.* The manuals shall include guidance on procedures to be followed in the event of a fault or failure of the inert gas system. (FSS Code, Ch. 15/2.2.5)

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* Refer to the *Revised Guidelines for inert gas systems* (MSC/Circ.353), as amended by MSC/Circ.387.

11.6.6.3 Requirements for flue gas and inert gas generator systems

In addition to the provisions in sec. 11.6.6.2 (FSS Code, par. 2.2), for inert gas systems using flue gas or inert gas generators, the provisions of this sec. 11.6.6.3 shall apply. (FSS Code, Ch. 15/2.3)

11.6.6.3.1 System requirements

11.6.6.3.1.1 Inert gas generators

11.6.6.3.1.1.1 Two fuel oil pumps shall be fitted to the inert gas generator. Suitable fuel in sufficient quantity shall be provided for the inert gas generators. (FSS Code, Ch. 15/2.3.1.1.1)

11.6.6.3.1.1.2 The inert gas generators shall be located outside the cargo tank area. Spaces containing inert gas generators shall have no direct access to accommodation service or control station spaces, but may be located in machinery spaces. If they are not located in machinery spaces, such a compartment shall be separated by a gastight steel bulkhead and/or deck from accommodation, service and control station spaces. Adequate positive-pressure-type mechanical ventilation shall be provided for such a compartment. (FSS Code, Ch. 15/2.3.1.1.2)

The space containing the inert gas generator should be indicated on entry door with the symbol used on the *Fire Control Plan*.

11.6.6.3.1.2 Gas regulating valves

11.6.6.3.1.2.1 A gas regulating valve shall be fitted in the inert gas main. This valve shall be automatically controlled to close, as required in par. 11.6.6.2.2.2 (FSS Code, par. 2.2.2.2). 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 inert gas flow rate. (FSS Code, Ch. 15/2.3.1.2.1)

11.6.6.3.1.2.2 The gas regulating valve shall be located at the forward bulkhead of the forward most gas-safe space through which the inert gas main passes. (FSS Code, Ch. 15/2.3.1.2.2)

11.6.6.3.1.3 Cooling and scrubbing arrangement

11.6.6.3.1.3.1 Means shall be fitted which will effectively cool the volume of gas specified in par. 11.6.6.2.1.2 (FSS Code, par. 2.2.1.2) 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 also be made for an alternative supply of cooling water. (FSS Code, Ch. 15/2.3.1.3.1)

11.6.6.3.1.3.2 Filters or equivalent devices shall be fitted to minimize the amount of water carried over to the inert gas blowers. (FSS Code, Ch. 15/2.3.1.3.2)

11.6.6.3.1.4 Blowers

11.6.6.3.1.4.1 At least two inert gas blowers shall be fitted and be capable of delivering to the cargo tanks at least the volume of gas required by par. 11.6.6.2.1.2 (FSS Code par. 2.2.1.2). For systems fitted with inert gas generators the Administration may permit only one blower if that system is capable of delivering the total volume of gas required by par. 11.6.6.2.1.2 (FSS Code, par. 2.2.1.2) to the cargo tanks, provided that sufficient spares for the blower and its prime mover are carried on board to enable any failure of the blower and its prime mover to be rectified by the ship's crew. (FSS Code, Ch. 15/2.3.1.4.1)

11.6.6.3.1.4.2 Where inert gas generators are served by positive displacement blowers, a pressure relief device shall be provided to prevent excess pressure being developed on the discharge side of the blower. (FSS Code, Ch. 15/2.3.1.4.2)

11.6.6.3.1.4.3 When two blowers are provided, the total required capacity of the inert gas system shall be divided evenly between the two and in no case is one blower to have a capacity less than 1/3 of the total required. (FSS Code, Ch. 15/2.3.1.4.3)

11.6.6.3.1.5 Inert gas isolating valves

For systems using flue gas, flue gas isolating valves shall be fitted in the inert gas 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, and precautions shall be taken to maintain them 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 valve is open. (FSS Code, Ch. 15/2.3.1.5)

11.6.6.3.1.6 Prevention of flue gas leakage

11.6.6.3.1.6.1 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. (FSS Code, Ch. 15/2.3.1.6.1)

11.6.6.3.1.6.2 To permit safe maintenance, an additional water seal or other effective means of preventing flue gas leakage shall be fitted between the flue gas isolating valves and scrubber or incorporated in the gas entry to the scrubber. (FSS Code, Ch. 15/2.3.1.6.2)

11.6.6.3.2 Indicators and alarms

11.6.6.3.2.1 In addition to the requirements in par. 11.6.6.2.4.2 (FSS Code, par. 2.2.4.2), means shall be provided for continuously indicating the temperature of the inert gas at the discharge side of the system, whenever it is operating. (FSS Code, Ch. 15/2.3.2.1)

11.6.6.3.2.2 In addition to the requirements of par. 11.6.6.2.4.5 (FSS Code, par. 2.2.4.5), audible and visual alarms shall be provided to indicate:

.1 insufficient fuel oil supply to the oil-fired inert gas generator;
.2 failure of the power supply to the generator;
.3 low water pressure or low water flow rate to the cooling and scrubbing arrangement;
.4 high water level in the cooling and scrubbing arrangement;
.5 high gas temperature;
.6 failure of the inert gas blowers; and
.7 low water level in the water seal. (FSS Code, Ch. 15/2.3.2.2)

11.6.6.4 Requirements for nitrogen generator systems

In addition to the provisions in sec. 11.6.6.2 (FSS Code 2.2), for inert gas systems using nitrogen generators, the provisions of this sec. 11.6.6.4 shall apply. (FSS Code, Ch. 15/2.4)

11.6.6.4.1 System requirements

11.6.6.4.1.1 The system shall be provided with one or more compressors to generate enough positive pressure to be capable of delivering the total volume of gas required by par. 11.6.6.2.1.2 (FSS Code, par 2.2.1.2). (FSS Code, Ch. 15/2.4.1.1)

Where two compressors are provided, the total required capacity of the system is preferably to be divided equally between the two compressors, and in no case is one compressor to have a capacity less than 1/3 of the total capacity required. (IACS UR F20.3.5)

11.6.6.4.1.2 A feed air treatment system shall be fitted to remove free water, particles and traces of oil from the compressed air. (FSS Code, Ch. 15/2.4.1.2)

The feed air treatment system fitted to remove free water, particles and traces of oil from the compressed air, is also to preserve the specification temperature. (IACS UR F20.3.6)

11.6.6.4.1.3 The air compressor and nitrogen generator may be installed in the engine-room or in a separate compartment. A separate compartment and any installed equipment shall be treated as an "Other machinery space" with respect to fire protection. Where a separate compartment is provided for the nitrogen generator, the compartment shall be fitted with an independent mechanical extraction ventilation system providing six air changes per hour. The compartment is to have no direct access to accommodation spaces, service spaces and control stations. (FSS Code, Ch. 15/2.4.1.3)

The space containing the nitrogen generator should be indicated on entrance door with the symbol used on the *Fire Control Plan*.

11.6.6.4.1.4 Where a nitrogen receiver or a buffer tank is installed, it may be installed in a dedicated compartment, in a separate compartment containing the air compressor and the generator, in the engine room, or in the cargo area. Where the nitrogen receiver or a buffer tank is installed in an enclosed space, the access shall be arranged only from the open deck and the access door shall open outwards. Adequate, independent mechanical ventilation, of the extraction type, shall be provided for such a compartment. (FSS Code, Ch. 15/2.4.1.4)

11.6.6.4.2 Indicators and alarms

11.6.6.4.2.1 In addition to the requirements in par. 11.6.6.2.4.2 (FSS Code, par. 2.2.4.2), instrumentation is to be provided for continuously indicating the temperature and pressure of air at the suction side of the nitrogen generator. (FSS Code, Ch. 15/2.4.2.1)

11.6.6.4.2.2 In addition to the requirements in sec. 11.6.6.2.4.5 (FSS Code, par. 2.2.4.5), audible and visual alarms shall be provided to include:

.1 failure of the electric heater, if fitted;
.2 low feed-air pressure or flow from the compressor;
.3 high-air temperature; and
.4 high condensate level at automatic drain of water separator. (FSS Code, Ch. 15/2.4.2.2)

11.6.6.4.3 Additional requirements for nitrogen generator systems on tankers, including chemical tankers, to which SOLAS reg. II-2/4.5.5.1 applies

11.6.6.4.3.1 The following requirements apply where a nitrogen generator system is fitted on board as required by sub-chapter 4.4.1.1 (SOLAS reg. II-2/4.5.5.1). For the purpose, the inert gas is to be produced by separating air into its component gases by passing compressed air through a bundle of hollow fibres, semi-permeable membranes or adsorber materials. (IACS UR F20.3.1)

11.6.6.4.3.2 In addition to the applicable requirements of this sec.11.6.6 (Ch. 15 of the FSS Code), the nitrogen generator system is to comply with SOLAS reg. II-2/4.5.3.4.2, 4.5.6.3 and 11.6.3.4. (IACS UR F20.3.2)

11.6.6.4.3.3 A nitrogen generator is to consist of a feed air treatment system and any number of membrane or adsorber modules in parallel necessary to meet par. 11.6.6.2.1.2.4 (FSS Code, par. 2.2.1.2.4). (IACS UR F20.3.3)

11.6.6.4.3.4 The nitrogen generator is to be capable of delivering high purity nitrogen in accordance with par. 11.6.6.2.1.2.5 (FSS Code par. 2.2.1.2.5). In addition to par. 11.6.6.2.2.4 (FSS Code, par. 2.2.2.4), the system is to be fitted with automatic means to discharge "off-spec" gas to the atmosphere during start-up and abnormal operation. (IACS UR F20.3.4)

11.6.6.4.3.5 The system is to be provided with one or more compressors to generate enough positive pressure to be capable of delivering the total volume of gas required by par. 11.6.6.2.1.4 (par. 2.2.1.2 of the FSS Code). Where two compressors are provided, the total required capacity of the system is preferably to be divided equally between the two compressors, and in no case is one compressor to have a capacity less than 1/3 of the total capacity required. (IACS UR F20.3.5)

11.6.6.4.3.6 The feed air treatment system fitted to remove free water, particles and traces of oil from the compressed air as required by par. 11.6.6.4.1.2 (par. 2.4.1.2 of Ch.15 of the FSS Code), is also to preserve the specification temperature. (IACS UR F20.3.6)

11.6.6.4.3.7 The oxygen-enriched air from the nitrogen generator and the nitrogen-product enriched gas from the protective devices of the nitrogen receiver are to be discharged to a safe location* on the open deck. (IACS UR F20.3.7)

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* "safe location" needs to address the two types of discharges separately:

1. oxygen-enriched air from the nitrogen generator - safe locations on the open deck are:
   - outside of hazardous area;
   - not within 3m of areas traversed by personnel; and
   - not within 6m of air intakes for machinery (engines and boilers) and all ventilation inlets.
2. nitrogen-product enriched gas from the protective devices of the nitrogen receiver - safe locations on the open deck are:
   - not within 3m of areas traversed by personnel; and
   - not within 6m of air intakes for machinery (engines and boilers) and all ventilation inlets/outlets.

11.6.6.4.3.8 In order to permit maintenance, means of isolation are to be fitted between the generator and the receiver. (IACS UR F20.3.8)

11.6.6.4.4 Nitrogen /Inert gas systems fitted for purposes other than inerting required by par. 11.6.4.1.1 and 11.8.6.1 (SOLAS Reg. II-2/4.5.5.1 and 4.5.5.2)

11.6.6.4.4.1 This sec. 11.6.6.4.4 applies to systems fitted on oil tankers, gas tankers or chemical tankers to which par. 11.6.4.1.1 and 11.8.6.1 (SOLAS reg. II-2/4.5.5.1 and 4.5.5.2) do not apply. (IACS UR F20.4.1)

11.6.6.4.4.2 Paragraphs 11.6.6.2.2.2, 11.6.6.2.2.4, 11.6.6.2.4.2, 11.6.6.2.4.3, 11.6.6.2.4.5.1.1, 11.6.6.2.4.5.1.2, 11.6.6.2.4.5.4, 11.6.6.4.1.1, 11.6.6.4.1.2, 11.6.6.4.1.3, 11.6.6.4.1.4, 11.6.6.4.2.1 and 11.6.6.4.2.2 (FSS Code par. 2.2.2.2, 2.2.2.4, 2.2.4.2, 2.2.4.3, 2.2.4.5.1.1, 2.2.4.5.1.2, 2.2.4.5.4, 2.4.1.1, 2.4.1.2, 2.4.1.3, 2.4.1.4, 2.4.2.1 and 2.4.2.2), as applicable apply to the systems. (IACS UR F20.4.2)

11.6.6.4.4.3 The requirements of sec. 11.6.6.4.3 (section F20.3) apply except par. 11.6.6.4.3.1, 11.6.6.4.3.2, 11.6.6.4.3.3 and 11.6.6.4.3.5 (par. F20.3.1, F20.3.2, F20.3.3 and F20.3.5). (IACS UR F20.4.3)

11.6.6.4.4.4 Materials used in inert gas systems are to be suitable for their intended purpose in accordance with this *Part V* (Rules of the Classification Society). (IACS UR F20.4.4)

11.6.6.4.4.5 All the equipment is to be installed on board and tested under working conditions to the satisfaction of the PRS Surveyor. (IACS UR F20.4.5)

11.6.6.4.4.6 The two non-return devices as required by par. 11.6.6.2.3.1.1 (FSS Code, par. 2.2.3.1.1) are to be fitted in the inert gas main. The non-return devices are to comply with par. 11.6.6.2.3.1.2 and 11.6.6.2.3.1.3 (FSS Code, par. 2.2.3.1.2 and 2.2.3.1.3); however, where the connections to the cargo tanks, to the hold spaces or to cargo piping are not permanent, the non-return devices required by par. 11.6.6.2.3.1.1 (FSS Code, par. 2.2.3.1.1) may be substituted by two non-return valves. (IACS UR F20.4.6)

11.6.6.5 Constant Operative Inerting Systems (COIS) as an Alternative to Fixed Hydrocarbon Gas Detection Equipment

A "Constant Operative Inerting System" (COIS) is a permanently fitted inert gas system connected to those spaces detailed in par. 11.6.4.3.3.1 (SOLAS Reg. II-2/4.5.7.3.1) in lieu of a fixed hydrocarbon gas detection system. The system complies with the requirements for inert gas systems for cargo tanks and is capable of constantly maintaining such spaces under an inert atmosphere at all times except when all adjacent spaces have been confirmed gas free for the purpose of entry. (IACS REC. 131, par.2)

The COIS, if provided, should comply with IACS REC. 131.

11.6.6.6 Tests of the inert gas systems after installation on board

11.6.6.6.1 After fitting on board, all inert gas and nitrogen piping of the system shall be pressure tested by compressed air with the test pressure at least 1.25 working pressure. Piping of cooling and scrubbing water systems, and piping of wet type deck seal arrangement shall be hydraulic pressure tested with the test pressure at least 1.25 working pressure.

11.6.6.6.2 After installation on board, the system is subject to functional tests in accordance with the agreed acceptance and test program.

11.6.7 Fixed hydrocarbon gas detection systems

11.6.7.1 Application

11.6.7.1.1 This sec.11.6.7 (sub-chapter) details the specifications for fixed hydrocarbon gas detection systems as required by this *Part V* (chapter II-2 of the SOLAS Convention). (FSS Code, Ch. 16/1.1)

11.6.7.1.2 A combined gas detection system required by sec. 11.6..4.3.3 and 11.6.4.7 (SOLAS reg. II-2/4.5.7.3 and II-2/4.5.10) may be accepted in cases where the system fully complies with the requirement of sec. 10.2 to 10.4 (SOLAS reg. II-2/2). (FSS Code, Ch. 16/1.2)

11.6.7.2 General

11.6.7.2.1 The fixed hydrocarbon gas detection system referred to in this *Part V* (SOLAS chapter II-2) shall be designed, constructed and tested to the satisfaction of the Administration based on performance standards developed by the Organization*. (FSS Code, Ch. 16/2.1.1)

* Refer to the *Guidelines for the design, construction and testing of fixed hydrocarbon gas detection system* (MSC.1/Circ.1370).

See IACS REC. 123: *Recommendation based on IMO instruments -MSC.1/Circ.1370 "Guidelines for the design, construction and testing of fixed hydrocarbon gas detection systems".*

11.6.7.2.2 The system shall be comprised of a central unit for gas measurement and analysis and gas sampling pipes in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks. (FSS Code, Ch. 16/2.1.2)

11.6.7.2.3 The system may be integrated with the cargo pump-room gas detection system, provided that the spaces referred to in par. 11.6.7.2.2 (FSS Code, par. 2.1.2) are sampled at the rate required in par. 11.6.7.6.1 (FSS Code, par. 2.2.3.1). Continuous sampling from other locations may also be considered provided the sampling rate is complied with. (FSS Code, Ch. 16/2.1.3)

11.6.7.3 Component requirements

11.6.7.3.1 Gas sampling lines

11.6.7.3.1.1 Common sampling lines* to the detection equipment shall not be fitted , except the lines serving each pair of sampling points as required in par. 11.6.7.4.3. (FSS Code, par. 2.2.1.3). (FSS Code, Ch. 16/2.2.1.1)

IACS recommendation

.1 The gas detection system should be arranged with single sampling lines from each sampling point to the gas detection cabinet; and

.2 Sampling lines from each sampling point in the same space may however be combined at deck level via a manually operated three-way valve arrangement. The valve should be provided with local indication of which sampling point is active (top or bottom). A signboard should be provided in the Cargo Control Room to specify the procedure for manual operation of valves depending on operational mode as follows:

- *in loaded condition: valve to be set so that lower sampling point is active.*
- *in ballast/partial ballast condition: valve to be set so that upper sampling point is active. (IACS REC. 123, par. 1.1)*

11.6.7.3.1.2 The materials of construction and the dimensions of gas sampling lines shall be such as to prevent restriction. Where non-metallic materials are used, they shall be electrically conductive. The gas sampling lines shall not be made of aluminium. (FSS Code, Ch. 16/2.2.1.2)

11.6.7.3.1.3 The configuration of gas sampling lines shall be adapted to the design and size of each space. Except as provided in par. 11.6.7.4.4 and 11.6.7.4.5 (FSS Code, par. 2.2.1.4 and 2.2.1.5), 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 where sampling is required. When 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 girder of bottom shell plating but at least 0.5 m from the bottom of the tank and it shall be provided with means to be closed when clogged. In positioning the fixed sampling points, due regard should also be given to the density of vapours of the oil products intended to be transported and the dilution from space purging or ventilation. (FSS Code, Ch. 16/2.2.1.3)

11.6.7.3.1.4 For ships with deadweight of less than 50,000 tonnes, the Administration may allow the installation of one sampling location for each tank for practical and/or operational reasons. (FSS Code, Ch. 16/2.2.1.4)

11.6.7.3.1.5 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*. (FSS Code, Ch. 16/2.2.1.5)

IACS recommendation

.1 For void spaces and other dry compartments such as ballast pump-rooms, one bottom sampling detector is acceptable.

.2 For ballast tanks and fresh water tanks, top and bottom sampling points shall be provided unless the prohibition of partial filling is clearly stated in the Stability Booklet/Loading Manual. (IACS REC. 123, par. 2.1)

11.6.7.3.1.6 Means shall be provided to prevent gas sampling lines from clogging when tanks are ballasted by using compressed air flushing to clean the line after switching from ballast to cargo loaded mode. The system shall have an alarm to indicate if the gas sampling lines are clogged. (FSS Code, Ch. 16/2.2.1.6)

11.6.7.3.2 Gas analysis unit

11.6.7.3.2.1 The 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 observed:

.1 sampling lines shall not run through gas safe spaces, except where permitted under subparagraph .5;

.2 the hydrocarbon gas sampling pipes shall be equipped with flame arresters. Sample hydrocarbon gas is to be led to the atmosphere with outlets arranged in a safe location, not close to a source of ignitions and not close to the accommodation area air intakes;

.3 a 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 the 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 is to be monitored by its own sampling point. At a gas concentration above 30% of the lower flammable limit inside the steel enclosure the entire gas analysing unit is to be automatically shut down; and

.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 are to be routed on their shortest ways. (FSS Code, Ch. 16/2.2.2.1)

11.6.7.3.2.2 Location of the gas analysis unit should be marked with the symbol used on *Fire Control Plan*.

11.6.7.3.3 Gas detection equipment

11.6.7.3.3.1 The 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. (FSS Code, Ch. 16/2.2.3.1)

11.6.7.3.3.2 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. (FSS Code, Ch. 16/2.2.3.2)

11.6.7.3.3.3 Audible and visual alarms are to be initiated in the cargo control room, navigation bridge and at the analysing unit when the vapour concentration in a given space reaches a pre-set value, which shall not be higher than the equivalent of 30% of the lower flammable limit. (FSS Code, Ch. 16/2.2.3.3)

11.6.7.3.3.4 The gas detection equipment shall be so designed that it may readily be tested and calibrated. (FSS Code, Ch. 16/2.2.3.4)

11.6.7.4 Tests of the system after installation on board

11.6.7.4.1 After fitting on board, all gas sampling lines of the system shall be tested for tightness using compressed air or nitrogen.

11.6.7.4.2 After installation on board, the system is subject to functional tests in accordance with the agreed acceptance and test program.

11.6.8 Fire safety operational booklet

11.6.8.1 General

The fire safety operational booklet referred to in par. 1.3.3.3 (SOLAS par.16.2) shall include provisions for preventing fire spread to the cargo area due to ignition of flammable vapours and include procedures of cargo tank gas-purging and/or gas-freeing taking into account the provisions in sec. 4.6.6.2. (SOLAS par. 3.2). (SOLAS II-2/16.3.1)

11.6.8.2 Procedures for cargo tank purging and/or gas-freeing

11.6.8.2.1 When the ship is provided with an inert gas system, the cargo tanks shall first be purged in accordance with the provisions of sec. 4.4.2 (SOLAS reg. 4.5.6) until the concentration of hydrocarbon vapours in the cargo tanks has been reduced to less than 2% by volume. Thereafter, gas-freeing may take place at the cargo tank deck level. (SOLAS II-2/16.3.2.1)

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

.1 the vent outlets as specified in sec. 17.6.6.7 of *Part VI* (SOLAS reg. 4.5.3.4);

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

.3 outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 20 m/s and which are protected by suitable devices to prevent the passage of flame. (SOLAS II-2/16.3.2.2)

11.6.8.2.3 The above outlets* shall be located not less than 10 m measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, includes anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard. (SOLAS II-2/16.3.2.3)

**** IMO interpretation***

If, under the requirements of this sub-chapter *(SOLAS Convention, IBC Code or IGC Code**), owing to the design of a ship, it is impossible in practice, or unreasonable, to fulfil the requirements relating to the location of access doors, air inlets or other openings in superstructures and/or deckhouses, the Administration or recognized organization acting on its behalf may adopt alternative provisions provided that, as a consequence of doing so, no ignition source is located in the hazardous areas defined in publication IEC 60092-502, except for electrical installations that have the required protection and have been certified as safe under that standard. (MSC.1/Circ.1459)*

** *E.g. SOLAS reg. II-2/4.5.2.1, 4.5.2.2, 4.5.3.4.1, 11.6.2 and 16.3.2.3; IBC Code, par. 3.2.3, 3.7.4, 8.3.4 and 8.5.1; and IGC Code, par. 3.2.4, 3.8.4, 8.2.9, 8.2.10.*

11.6.8.2.4 When the flammable vapour concentration at the outlet has been reduced to 30% of the lower flammable limit, gas-freeing may be continued at cargo tank deck level. (SOLAS II-2/16.3.2.4)

11.6.8.3 Operation of inert gas system

Each tanker shall be provided with operation manual of inert gas system containing information given below:

11.6.8.3.1 The inert gas system for tankers required in accordance with sec. 11.6.4.1.1 (SOLAS reg. 4.5.5.1) shall be so operated as to render and maintain the atmosphere of the cargo tanks non-flammable, except when such tanks are required to be gas-free. (SOLAS II-2/16.3.3.1)

11.6.8.3.2 If the oxygen content of the inert gas exceeds 5% by volume, immediate action shall be taken to improve the gas quality. Unless the quality of the gas improves, all operations in those cargo tanks to which inert gas is being supplied shall be suspended so as to avoid air being drawn into the cargo tanks, the gas regulating valve, if fitted, shall be closed and the off-specification gas shall be vented to atmosphere. (SOLAS II-2/16.3.3.3)

11.6.8.3.3 In the event that the inert gas system is unable to meet the requirement in par. 11.6.8.3.1 (SOLAS par. 16.3.3.1) and it has been assessed that it is impractical to effect a repair, then cargo discharge and cleaning of those cargo tanks requiring inerting shall only be resumed when suitable emergency procedures have been followed, taking into account guidelines developed by Organization*. (SOLAS II-2/16.3.3.4)

* Refer to the *Clarification of inert gas system requirements under the Convention* (MSC/Circ.485 , as amended) and *Revised Guidelines for inert gas systems* (MSC/Circ.353), as amended by MSC/Circ.387.

11.6.9 Requirements for tankers (Product Carriers) carrying cargoes having a flash-point exceeding 60°C – Mark: PRODUCT CARRIER B

These product carriers shall comply with the requirements for cargo ships other than tankers, with exceptions specified in par.11.6.1.3. Cargo pump-room are to be considered as machinery spaces of category A.

11.7 Tankers – additional mark: TANKER FOR ....

There are no additional requirements with regard to fire protection of such ships.

11.8 Chemical tankers – additional mark: CHEMICAL TANKER

Chemical tankers, in terms of fire protection, depending on carried liquid products that pose a fire hazard, shall fulfil the requirements of this sub-chapter 11.8 and relevant provisions of the *IBC Code,* as amended.

This sub-chapter 11.8 is based on chapters 11 and 14 of the *IBC Code*, taking into account the applicable interpretations and recommendations of the IMO and IACS instruments.

11.8.1 Application

11.8.1.1 The requirements for tankers in *this Part V* (SOLAS chapter II-2) shall apply to ships covered by *IBC Code*, irrespective of tonnage, including ships of less than 500 tons gross tonnage, except that:

- **.1** sec. 11.6.4.6 regarding protection of cargo tanks by fixed deck foam systems and sec. 11.6.4.7 regarding protection of cargo pump-rooms (SOLAS reg. 10.8 and 10.9) shall not apply;
- **.2** par. 11.6.2.1.2 (SOLAS reg. 4.5.1.2) (i.e. the requirements for location of the main cargo control station) need not apply;
- **.3** sub-chapters 3.2 and 6.2 regarding water fire main system and fire extinguishing arrangements in machinery spaces (SOLAS reg.10.2, 10.4, and 10.5) shall apply as they would apply to cargo ships of 2 000 tons gross tonnage and over;
- **.4** sec. 6.2.7 regarding fixed water-based local application fire-fighting systems (SOLAS reg.10.5.6) shall apply to ships of 2 000 gross tonnage and over;
- **.5** the provisions of sec. 11.8.3 regarding fire protection of cargo area (IBC Code 11.3) shall apply in lieu of sec. 11.6.4.6 (SOLAS reg.10.8);
- **.6** the provisions of sec. 11.8.2 regarding fire protection of cargo pump-rooms (IBC Code 11.2) shall apply in lieu of sec. 11.6.4.7 (SOLAS reg. 10.9);
- **.7** sec. 11.6.4.7.3 regarding additional measures to prevent explosions in cargo pump rooms (SOLAS reg. 4.5.10) shall apply to ships of 500 gross tonnage and over, replacing "hydrocarbon gases" by "flammable vapours" in the regulation; and
- **.8** sec. 2.3.2.7 and 2.3.3.7 regarding emergency escape breathing devices (SOLAS reg.13.3.4 and 13.4.3) shall apply to ships of 500 gross tonnage and over. (IBC Code, Ch. 11.1.1, MSC.1/Circ.1323 and IACS UI CC5)

11.8.1.2 Notwithstanding the provisions of par. 11.1.1, ships engaged solely in the carriage of products which are non-flammable (entry NF in column "i" of the table of minimum requirements in IBC Code) need not comply with requirements for tankers specified in this *Part V* (SOLAS chapter II-2), provided that they comply with the requirements for cargo ships of this *Part V*, except that sec. 6.5 regarding fire-extinguishing arrangements in cargo spaces (SOLAS reg. II-2/10.7) need not apply to such ships and sec. 11.8.2 and 11.8.3 (IBC Code 11.2 and 11.3), hereunder, need not apply. (IBC Code, Ch. 11.1.2)

11.8.1.3 For ships engaged solely in the carriage of products with a flashpoint of 60°C and above (entry "Yes" in column "i" of the table of minimum requirements in IBC Code), the requirements of this *Part V*, for cargo ships, (SOLAS chapter II-2) may apply as specified in par. 11.6.1.3 (SOLAS reg. II-2/1.6.4) in lieu of the provisions of this sub-chapter 11.8 (chapter). (IBC Code, Ch. 11.1.3)

11.8.1.4 A liquid cargo with a flashpoint of less than 60°C for which a regular foam fire-fighting system complying with requirement of sub-chapter 11.6.5 (FSS Code) is not effective, is considered to be a cargo introducing additional fire hazards in this context. The following additional measures are required:

.1 the foam shall be of alcohol resistant type;

.2 the type of foam concentrates for use in chemical tankers shall be to the satisfaction of the Administration taking into account the guidelines developed by the Organization;*

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

.3 the capacity and application rates of the foam extinguishing system shall comply with sec. 11.8.4 (IBC Code), except that lower application rates may be accepted based on performance tests. For tankers fitted with inert gas systems, a quantity of foam concentrate sufficient for 20 min of foam generation may be accepted.** (SOLAS II-2/1.6.2.1)

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

11.8.1.5 For the purpose of this sub-chapter 11.8 (regulation), a liquid cargo with a vapour pressure greater than 1.013 bar absolute at 37.8°C is considered to be a cargo introducing additional fire hazards. Ships carrying such substances shall comply with paragraph 15.14 of the IBC Code. When ships operate in restricted areas and at restricted times, the Administration concerned may agree to waive the requirements for refrigeration systems in accordance with paragraph 15.14.3 of IBC Code. (SOLAS II-2/1.6.2.2)

11.8.1.6 Liquid cargoes with a flashpoint exceeding 60°C other than oil products or liquid cargoes subject to the requirements of the IBC Code are considered to constitute a low fire risk, not requiring the protection of a fixed foam extinguishing system. (SOLAS II-2/1.6.3)

11.8.1.7 Chemical tankers (...) shall comply with the requirements for tankers, except where alternative and supplementary arrangements are provided to the satisfaction of the Administration, having due regard to the provisions of IBC Code (...), as appropriate. (SOLAS II-2/1.6.6)

11.8.2 Fire protection of cargo pump-rooms

11.8.2.1 The cargo pump-room of any ship shall be provided with a fixed carbon dioxide fire extinguishing system as specified in par. 11.6.4.7.1.1 (SOLAS reg. II-2/10.9.1.1). A notice shall be exhibited at the controls stating that the system is only to be used for fire-extinguishing and not for inerting purposes, due to the electrostatic ignition hazard. The alarms referred to in par. 11.6.4.7.1.1.1 (SOLAS reg. II-2/10.9.1.1.1) shall be safe for use in a flammable cargo vapour/air mixture. For the purpose of this requirement, an extinguishing system shall be provided which would be suitable for machinery spaces. However, the amount of gas 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. (IBC Code, Ch. 11.2.1)

11.8.2.2 Cargo pump-rooms of ships which are dedicated to the carriage of a restricted number of cargoes shall be protected by an appropriate fire-extinguishing system approved by the Administration. (IBC Code, Ch. 11.2.2)

11.8.2.3 If cargoes are to be carried which are not suited to extinguishment by carbon dioxide or equivalent media, the cargo pump room shall be protected by a fire extinguishing system consisting of either a fixed pressure water spray or high expansion foam system. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall reflect this conditional requirement. (IBC Code, Ch. 11.2.3)

11.8.3 Fire protection of cargo area

11.8.3.1 Every ship shall be provided with a fixed deck foam system in accordance with the requirements of sec. 11.8.4 (IBC Code 11.3.2 to 11.3.12). (IBC Code, Ch. 11.3.1)

11.8.3.2 Ships which are dedicated to the carriage of a restricted number of cargoes shall be protected by alternative provisions to the satisfaction of the Administration when they are just as effective for the products concerned as the deck foam system required for the generality of flammable cargoes. (IBC Code, Ch. 11.3.13)

11.8.3.3 Suitable portable fire-extinguishing equipment* for the products to be carried shall be provided and kept in good operating order. (IBC Code, Ch. 11.3.14)

* ***IMO interpretation***

The capacity of portable fire-extinguishing equipment should be as specified in sub-chapter 5.2 (SOLAS Convention, as amended). (MSC/Circ.406/Rev.1)

11.8.3.4 Where flammable cargoes are to be carried, all sources of ignition shall be excluded from hazardous locations unless such sources conform with par.10.1.4 of IBC Code. (IBC Code, Ch. 11.3.15)

11.8.3.5 Ships fitted with bow or stern loading and unloading arrangements shall be provided with one additional foam monitor meeting the requirements of par. 11.8.4.7 (IBC Code 11.3.7) and one additional applicator meeting the requirements of par. 11.8.4.10 (IBC Code 11.3.10). The additional monitor shall be located 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. (IBC Code, Ch. 11.3.16)

11.8.4 Fixed deck foam system

11.8.4.1 The system shall comply with applicable requirements of sec. 11.6.5 and paragraphs below.

11.8.4.2 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 the Administration shall be provided. Regular protein foam shall not be used. (IBC Code, Ch. 11.3.2)

11.8.4.3 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. (IBC Code, Ch. 11.3.3)

11.8.4.4 The deck foam system shall be capable of simple and rapid operation. The main control station for the system shall be suitably located outside of the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fires in the areas protected. (IBC Code, Ch. 11.3.4)

11.8.4.5 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;

.3 10 *l*/min per square metre of the area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1,250 l/min. For ships less than 4 000 tonnes deadweight, the minimum capacity of the monitor shall be to the satisfaction of the Administration*. (IBC Code, Ch. 11.3.5)

*** IMO interpretation***

For ships of less than 4000 tonnes deadweight the minimum capacity of a monitor should be 1000 l/min and the application rate should be at least 10 l/min/m² of the surface to be protected. (MSC/Circ.406/Rev.1)

11.8.4.6 Sufficient foam concentrate shall be supplied to ensure at least 30 min of foam generation when using the highest of the solution rates stipulated in par. 11.8.4.5.1, 11.8.4.5.2 and 11.8.4.5.3 (IBC Code 11.3.5.1, 11.3.5.2 and 11.3.5.3). (IBC Code, Ch. 11.3.6)

11.8.4.7 Foam from the fixed foam system shall be supplied by means of monitors and foam applicators. At least 50% of the foam rate required in par. 11.8.4.5.1 or 11.8.4.5.2 (IBC Code 11.3.5.1 or 11.3.5.2) 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 ships less than 4,000 tonnes deadweight, the minimum capacity of the monitor shall be to the satisfaction of the Administration*. (IBC Code, Ch. 11.3.7)

*** IMO interpretation***

For ships of less than 4000 tonnes deadweight the minimum capacity of a monitor should be 1000 l/min and the application rate should be at least 10 l/min/m² of the surface to be protected. (MSC/Circ.406/Rev.1)

11.8.4.8 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. (IBC Code, Ch. 11.3.8)

11.8.4.9 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. (IBC Code, Ch. 11.3.9)

11.8.4.10 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. (IBC Code, Ch. 11.3.10)

11.8.4.11 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. (IBC Code, Ch. 11.3.11)

11.8.4.12 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*. (IBC Code, Ch. 11.3.12)

*** *IMO interpretation***

The simultaneous use of the minimum number of jets of water should be possible on deck over the full length of the ship, in the accommodation, service spaces, control spaces and machinery spaces. (MSC/Circ.406/Rev.1)

11.8.5 Special requirements

All fire-extinguishing media determined to be effective for each product are listed in column l in the table of chapter 17 of IBC Code. (IBC Code, Ch. 11.4)

11.8.6 Inert gas systems of chemical tankers

11.8.6.1 The requirements for inert gas systems contained in sec. 11.6.6 (FSS Code) need not be applied to chemical tankers (…):

.1 when carrying cargoes described in par. 11.6.1.1 – products having a flashpoint not exceeding 60°C (SOLAS reg. 1.6.1), provided that they comply with the requirements for inert gas systems on chemical tankers established by the Administration, based on the guidelines developed by the Organization *; or

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* Refer to the *Regulation for inert gas systems on chemical tankers* (resolution A.567(14) and Corr.1).

.2 when carrying flammable cargoes other than crude oil or petroleum products such as cargoes listed in chapters 17 and 18 of IBC Code, provided that the capacity of tanks used for their carriage does not exceed 3,000 m^3 and the individual nozzle capacities of tank washing machines do not exceed 17.5 m^3/h and the total combined throughput from the number of machines in use in a cargo tank at any one time does not exceed 110 m^3/h. (SOLAS II-2/4.5.5.2.1)

11.8.7 Operation of inert gas system

11.8.7.1 Each chemical tanker shall be provided with operation manual of inert gas system containing information given in sec. 11.6.8.3 and in par. 11.8.7.2 below.

11.8.7.2 For chemical tankers, the application of inert gas*, may take place after the cargo tank has been loaded, but before commencement of unloading and shall continue to be applied until that cargo tank has been purged of all flammable vapours before gas-freeing. Only nitrogen is acceptable as inert gas under this provision. (SOLAS II-2/16.3.3.2)

*** *IMO interpretation***

When a product containing an oxygen-dependent inhibitor is carried on a ship for which inerting is required under SOLAS chapter II-2, the inert gas system shall be operated as required to maintain the oxygen level in the vapour space of the tank at or above the minimum level of oxygen required under paragraph 15.13 of the IBC Code and as specified in the Certificate of Protection. (MSC.1/Circ.1501)

11.8.8 Application of aluminium coatings

Chemical tankers shall fulfil the requirements concerning application of aluminium coatings for the hull and piping specified in par. 11.6.4.10. (IACS UR F2)

11.8.9 Temperature of steam and heating media within the cargo area

On chemical tankers, the maximum temperature is to be adjusted to take into account the temperature class of the cargoes. (IACS UR F24)

11.8.10 Personnel protection

11.8.10.1 Protective equipment

11.8.10.1.1 For the protection of crew members who are engaged in loading and discharging operations, the ship shall have on board suitable protective equipment consisting of large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical-resistant material, and tight-fitting goggles or face shields or both. The protective clothing and equipment shall cover all skin so that no part of the body is unprotected. (IBC Code, Ch. 14.1.1)

11.8.10.1.2 Work clothes and protective equipment shall be kept in easily accessible places and in special lockers*. Such equipment shall not be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. The Administration may, however, approve storage rooms for such equipment within accommodation spaces if adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc. (IBC Code, Ch. 14.1.2)

IMO interpretation

Lockers for work clothes and protective equipment which are not new or have not undergone a thorough cleaning process should not open directly into accommodation spaces. (MSC/Circ.406/Rev.1)

11.8.10.1.3 Protective equipment shall be used in any operation, which may entail danger to personnel. (IBC Code, Ch. 14.1.3)

11.8.10.2 Safety equipment*

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* See MSC/Circ.1095 *Revised minimum safety standards for ships carrying liquids in bulk containing benzene.*

11.8.10.2.1 Ships carrying cargoes for which special requirements of IBC Code 15.12, 15.12.1 or 15.12.3 is listed in column "o" in the table of chapter 17 of IBC Code, shall have on board sufficient but not less than three complete sets of safety equipment, complying with par. 11.8.10.2.2, each permitting personnel to enter a gas-filled compartment and perform work there for at least 20 min. Such equipment shall be in addition to that required by sub-chapter 6.7 (SOLAS reg. II-2/10.10). (IBC Code, Ch. 14.2.1)

11.8.10.2.2 One complete set of safety equipment shall consist of:

.1 one self-contained air-breathing apparatus (not using stored oxygen);

.2 protective clothing, boots, gloves and tight-fitting goggles;

.3 fireproof lifeline with belt resistant to the cargoes carried; and

.4 explosion-proof lamp. (IBC Code, Ch. 14.2.2)

11.8.10.2.3 For the safety equipment required in par. 11.8.10.2.1 (IBC Code 14.2.1), all ships shall carry either:

.1 one set of fully charged spare air bottles for each breathing apparatus;

.2 a special air compressor suitable for the supply of high-pressure air of the required purity;

.3 a charging manifold capable of dealing with sufficient spare air bottles for the breathing apparatus; or

.4 fully charged spare air bottles with a total free air capacity of at least 6,000 l for each breathing apparatus on board in excess of sub-chapter 6.7 (SOLAS reg. II-2/10.10). (IBC Code, Ch. 14.2.3)

11.8.10.2.4 A cargo pump-room on ships carrying cargoes which are subject to the requirements of IBC Code 15.18 or cargoes for which in column k in the table of chapter 17 of IBC Code, toxic-vapour-detection equipment is required but is not available shall have either:

.1 a low-pressure line system with hose connections suitable for use with the breathing apparatus required by par. 11.8.10.2.1 (IBC Code 14.2.1). This system shall provide sufficient high pressure air capacity to supply, through pressure-reduction devices, enough low pressure air to enable two men to work in a gas-dangerous space for at least 1 h without using the air bottles of the breathing apparatus. Means shall be provided for recharging the fixed air bottles and the breathing apparatus air bottles from a special air compressor suitable for the supply of high-pressure air of the required purity; or

.2 an equivalent quantity of spare bottled air* in lieu of the low-pressure air line. (IBC Code, Ch. 14.2.4)

**** IMO interpretation***

The equivalent quantity of spare bottled air in lieu of the low-pressure air line should be at least 4800 litres. (MSC/Circ.406/Rev.1)

11.8.10.2.5 At least one set of safety equipment as required by par. 11.8.10.2.2 (IBC Code 14.2.2) shall be kept in a suitable clearly marked locker in a readily accessible place near the cargo pump-room. The other sets of safety equipment shall also be kept in suitable, clearly marked, easily accessible places. (IBC Code, Ch. 14.2.5)

11.8.10.2.6 The breathing apparatus shall be inspected at least once a month by a responsible officer, and the inspection recorded in the ship' s log-book. The equipment shall be inspected and tested by an expert at least once a year. (IBC Code, Ch. 14.2.6)

11.8.10.3 Emergency equipment

11.8.10.3.1 Ships carrying cargoes, for which "Yes" is indicated in column *n* of chapter 17 of IBC Code, shall be provided with suitable respiratory and eye protection sufficient for every person on board for emergency escape purposes, subject to the following:

.1 filter-type respiratory protection is unacceptable;

.2 self-contained breathing apparatus shall have at least a duration of service of 15 min;

.3 emergency escape respiratory protection shall not be used for fire-fighting or cargo handling purposes and shall be marked to that effect. (IBC Code, Ch. 14.3.1)

11.8.10.3.2 The ship shall have on board medical first-aid equipment, including oxygen resuscitation equipment and antidotes for cargoes to be carried, based on the guidelines developed by the Organization*. (IBC Code, Ch. 14.3.2)

* Reference is made to the *Medical First Aid Guide for Use in Accidents Involving Dangerous Goods,* which provides advice on the treatment of casualties in accordance with the symptoms exhibited as well as equipment and antidotes that may be appropriate for treating the casualty.

11.8.10.3.3 A stretcher which is suitable for hoisting an injured person up from spaces such as the cargo pump-room shall be placed in a readily accessible location. (IBC Code, Ch. 14.3.3)

11.8.10.3.4 Suitably marked decontamination showers and an eyewash shall be available on deck in convenient locations. The showers and eyewash shall be operable in all ambient conditions. (IBC Code, Ch. 14.3.4)

11.9 Gas tankers – additional mark: LIQUEFIED GAS TANKER

Fire protection and extinction of these ships shall comply with applicable requirements of Rules for the Classification and Construction of Sea-going Gas Tankers.

For gas tankers intended to the carriage of liquefied hydrogen only, the fire protection requirements shall additionally take into account Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk, contained in Res. MSC.420(97).

11.10 Ships combating spills – additional marks: OIL RECOVERY VESSEL, CHEMICAL RECOVERY VESSEL

11.10.1 Application

Requirements of this sub-chapter 11.10 apply to vessels which, in case of an accident involving hazardous chemical substances, may be used for rescue, and for searching and combating such substances, when traveling without any restriction in hazardous (explosive or toxic) atmosphere and in the spilled liquid chemical substance.

11.10.2 Definitions

Definitions given in sec. 1.2 apply to this sub-chapter 11.10.

11.10.3 Classification documentation

11.10.3.1 Apart from documents referred to in sec. 1.3.1, the classification documentation, shall include:

- **.1** plan of the detection and alarm system for flammable and toxic gases, cover arrangement of system components, measuring points/gas detectors, air sampling pipes and electric circuit diagrams.
- **.2** a list of portable instruments for measuring concentrations of flammable gases and toxic substances, and oxygen content.

11.10.4 Vessel construction

11.10.4.1 The hull, superstructures, deckhouses and decks shall be made of steel. Structures made of aluminium alloys shall not be used.

11.10.4.2 The structure of the vessel, fire integrity of vertical and horizontal divisions shall comply with applicable requirements for tankers carrying cargo having a flashpoint not exceeding 60°C (closed cup test), listed in sec. 11.6.2 and 11.6.3.

11.10.4.3 External walls of superstructures and deckhouses are to be "A-60" Class structures along the entire height from the upper deck, unless the intensity of water supply to the water curtain systems in accordance with 11.6.10 makes it possible to reduce the thickness of the insulation.

11.10.4.4 Windows and sidescuttles in the superstructure are to be of "A-0" Class and be provided with steel covers.

11.10.4.5 Exits from superstructures and deckhouses to the open deck to explosive hazard zones shall be provided with air-locks with two gastight doors, spaced at least 1.5 m apart. External doors shall be of self-closing type. Sills of these doors shall be at least 300 mm high.

Spaces with an exit to an open deck may not have an airlock, if:

.1 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.

Air locks are also not required at the exits from the navigation bridge to the open deck.

11.10.4.6 Cargo tanks intended for the recovered oil shall be separated from other spaces by cofferdams. The function of cofferdams for such a cargo tanks may be performed by storage rooms of hazardous substances recovery equipment.

11.10.4.7 All openings in cargo tanks, cofferdams in cargo area, pump rooms and cargo tanks shall be fitted with gastight closures.

11.10.4.8 For the purpose of table 9.7 and 9.8 use, spaces for the storage of hazardous substances recovery equipment shall be treated as service spaces (high risk), category (9).

11.10.5 Escape routes

At least two escape routes shall be arranged from the hazardous area on the open deck. They shall be as far apart as possible, leading to entries to citadel and additionally to muster stations on embarkation deck.

11.10.6 Fire protection of cargo pump rooms

Where separate spaces (cargo pump rooms) are provided for pumps serving cargo tanks intended for collected liquid hazardous substances, fire protection of such spaces shall comply with the requirements of sec. 11.6.4.7.

11.10.7 Fire protection of machinery spaces

11.10.7.1 Onboard all vessels irrespective of their gross tonnage, machinery spaces of category A shall be equipped with fire detection and fire alarm system, complying with the requirements of sub-chapter 4.1 and a fixed fire extinguishing system required by sec. 6.2.1.

11.10.7.2 Fire extinguishing systems provided for the protection of machinery spaces shall be operated remotely from the navigation bridge/control station. Fire extinguishing stations intended for the protection of these spaces need not have entries leading directly to open deck.

11.10.7.3 High expansion foam fire-extinguishing system shall not be used to protect machinery spaces.

11.10.8 Fire protection of cargo spaces and store-rooms

11.10.8.1 Cargo spaces (holds) intended for collecting solid hazardous substances and the store-rooms for the storage of hazardous substances recovery equipment shall be provided with fire detection and fire alarm system or with sample extraction smoke detection system, complying with the requirements of sub-chapters 4.1 or 4.2.

11.10.8.2 Near the entrance to the store-room, a portable fire extinguisher shall be located, suitable for extinguishing group B fires, as well as fires of hazardous substances, the vessel is intended to collect.

11.10.8.3 Cargo spaces (holds) shall be provided with a fixed gas fire-extinguishing system, e.g. CO_2 fire-extinguishing system or equivalent, complying with requirements of sub-chapter 3.6.

11.10.9 Fire protection of helicopter landing area

The helicopter landing/winching area, if provided, shall comply with the applicable requirements of sub-chapter 12.8.

11.10.10 Water curtain system for self-protection of the vessel

11.10.10.1 The vessel shall be provided with a water curtain system designed to spray external walls of superstructure and open decks, for the protection against the effects of fire sources and for flushing settling hazardous substances. The system shall comply with relevant requirements of subchapter 11.11.8. During the system operation, proper visibility from the navigation bridge and from operating centre shall be ensured.

11.10.10.2 The water delivery rate of the water curtain system shall be at least 15 *l*/min per running meter of the wall and at least 5 *l*/min per a square meter of open deck.

11.10.10.3 The water curtain system shall be operated remotely from the navigation bridge or operating center.

11.10.11 Fixed deck foam system

11.10.11.1 A fixed deck foam system shall be fitted onboard the vessel. The system shall fulfil the applicable requirements for oil/ chemical tankers and be capable of delivering foam to the open deck to cover the whole cargo area.

11.10.11.2 The delivery rate of the foam concentrate solution shall be not less than 10 l/min per a square meter of cargo deck area.

11.10.11.3 The quantity of the foam concentrate shall be such as to ensure the system operation for at least 30 minutes – for the tanks intended for collecting liquid hazardous substances without cofferdams, and 20 minutes – for such tanks surrounded by cofferdams.

11.10.11.4 Additionally, 2 portable foam applicator units supplied with water from the fire mains, provided with at least 4 portable 20 litre foam concentrate containers, shall be located in an easily accessible place on the cargo deck level, for use during fire-fighting.

11.10.12 Water fire mains system

11.10.12.1 The system shall comply with the applicable requirements of sub-chapter 3.2 and the below additional requirements:

- **.1** it shall be designed as for tankers, to comply with applicable requirements given in sec. 11.6.4.8;
- **.2** the fire pumps shall be capable of being supplied with water from sea chests only, when the side sea valves are kept closed (during vessel's operation in oil/ chemical spill);
- **.3** the fire pumps shall be operated remotely from the navigation bridge or operating centre.

11.10.12.2 Additionally, 3 fire hoses with nozzles shall be located on the open deck.

11.10.12.3 All the fire hoses used on open decks shall be manufactured of materials resisting to hazardous substances the vessel is intended to recover.

11.10.13 The flammable and toxic gases detection and alarm system

11.10.13.1 The vessel shall be provided with a fixed detection and alarm system for any flammable and toxic gas which may occur in the vessel outside atmosphere during combating oil/ chemical pollution, complying with the applicable requirements of sec. 11.6.7.

11.10.13.2 The system shall be so designed that it can operate continuously when the vessel is travelling in hazardous atmosphere and during hazardous substances recovery operations.

11.10.13.3 The outside located components of the system (detectors/air sampling points, cables) shall be manufactured of materials resistant to the effect of marine environment and hazardous substances, the vessel is intended to recover. The system components shall be of type approved by PRS.

11.10.13.4 Where the system is provided with gas sampling lines, it shall comply with applicable requirements of sec. 11.6.7.3.1. The pipelines cross-section and length shall be such as to ensure delivery of sampled air to the gas measuring and analysis station within not more than 1 minute. The system shall ensure automatic sequential air control at all places where air sampling points or detectors are installed.

11.10.13.5 The system shall be constructed of components safe for use in an explosive atmosphere, complying with the requirements of *Part VIII*, sec.22.5.4.2.

11.10.13.6 For oil recovery vessels, measuring points of the gas detection and alarm system shall be distributed as follows:

.1 in the vicinity of the supply ventilation openings;
.2 in at least two places on the open deck, at a height not exceeding 1.0 m;
.3 in machinery spaces - in air locks;
.4 in cofferdams of cargo tanks.

11.10.13.7 For chemical recovery vessels, measuring points of the gas detection and alarm system shall be distributed as follows:

.1 For gases which are toxic and harmful to human health:
- on open decks;
- outside the superstructure, near the air inlets to the citadel;
- in the air locks;
- in the filter room, after main filter and safety filter of the air inlet to the citadel.

.2 For flammable gases:
- on open decks;
- outside the superstructure, near the air inlets to combustion engines and boilers;
- outside the superstructure, near the air inlets to the citadel;
- in cofferdams, ballast tanks and void spaces adjacent to cargo tanks;
- in cargo pump rooms.

11.10.13.8 Further measuring points may be required by PRS in consideration of special design solutions of the vessel and service conditions.

11.10.13.9 The setting of the detection of toxic and harmful substances shall be so adjusted that alarm is activated after detection of minimum concentration harmful for human health for substances the vessel is intended to recover.

11.10.13.10 The setting of the detection of flammable gases shall be such that the alarm is activated after detection of 30% of lower explosive limit (LEL) for the gas.

11.10.13.11 After exceeding the set limit value, the system shall activate an easy distinguishable visual and sound alarm on the open deck, as well as on the navigation bridge and in operating center.

11.10.13.12 If the gas detection system located after the main filter is not suitable for detecting all hazardous substances that can occur, the vessel shall be provided with a list of those substances which the system shall monitor.

11.10.13.13 The measuring point after the safety filter which is treated as the second measuring point after the main filter shall be independent of the general gas detection and alarm system. The audible and visual alarm activated by the measuring point shall be different from all other alarms and must be emitted on the navigation bridge and in the accommodation spaces.

11.10.14 Portable instruments for the measurement of concentration of flammable gases, toxic substances and of oxygen content

In addition to the fixed detection and alarm system for flammable and toxic gases, at least 2 portable instruments for detection of flammable and toxic gases and toxic substances concentration (classes 2.3 and 6.1) and for the measurement of oxygen content in outside atmosphere, together with a set of spare parts for each of instruments and its calibration equipment, shall be provided onboard.

11.10.15 Elimination of potential ignition sources

All electrical systems and equipment and all other equipment/ facilities/ portable equipment intended for use in zone 0 and zone 1 shall be of safe type for use in an explosive atmosphere, and shall comply with requirements given in *Part VIII*, sub-chapter ...

11.10.16 Personal protective equipment

11.10.16.1 For chemical recovery vessels, in addition to chemical protective clothing (working) for use during hazardous substances recovery operations, 4 sets of chemical protective clothing resistant to hazardous substances the vessel is intended to recover shall be provided onboard. These clothes are intended exclusively for use in emergency, in order to carry out rescue-extinguishing operations in hazardous areas.

11.10.16.2 In addition to the fire-fighter's outfits required in sec. 6.7.2, at least 2 sets of fire-fighter's outfit complying with the requirements of sec. 5.4 shall be provided onboard.

11.10.16.3 At least 2 additional self-contained breathing apparatus complying with the requirements of sub-chapter 5.4, shall be provided onboard.

11.10.17 Portable fire-extinguishers

At least 2 portable fire-extinguishers, suitable for extinguishing group B fires and fires of flammable hazardous substances the vessel is intended to recover, shall be placed onboard in places of easy access from the open deck.

11.10.18 Maintenance and safety operation documentation

Additionally to the requirements of sec. 1.3.3, the vessel shall carry the *Fire safety operational booklet* containing the below information:

.1 operating instructions for all variants of rescue-extinguishing operations performed during oil/ chemical recovery operations;

.2 diagrams, operating description and instructions of all fire-extinguishing systems and the detection and alarm system for flammable and toxic gases.

The *Maintenance plan*, required in par. 1.3.3.1 shall additionally include information on the flammable and toxic gases detection and alarm system.

11.11 Fire fighting ships – additional marks: FIRE FIGHTING SHIP 1a, FIRE FIGHTING SHIP 1, FIRE FIGHTING SHIP 2, FIRE FIGHTING SHIP 3

11.11.1 Application

11.11.1.1 The requirements specified in this sub-chapter 11.11 are applicable to Fire Fighting ships and ships having special fire-fighting capabilities, intended for fire-fighting and rescue operations.

11.11.1.2 A ship which fulfils the applicable requirements concerning structure and equipment will be assigned an additional mark **FIRE FIGHTING SHIP** and the appropriate class notation: **1** or **2**, or **3**, affixed to the symbol of class.

11.11.1.3 Fire Fighting ships with class notation are defined:

Class 1: ship with water spray protection for cooling the fire-fighting ship surfaces to enable close operation during early stages of fire-fighting.

Class 2: ship built for continuous fighting of fires and cooling structures on fire.

Class 3: ship with enhanced fire-fighting capabilities for continuous fighting of large fires and cooling structures on fire.

11.11.1.4 A ship, which, in addition to compliance with the requirements for **2** or **3** notation assignment, is provided 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.

11.11.1.5 Ships not in full compliance the requirements of this section or not specifically built for the service intended to be covered by these requirements, but which have some fire-fighting capability in addition to their regular service, may be considered as falling under the intent of this section, in relation to the specific fire-fighting requirements. Such ships can be assigned an additional mark **FIRE FIGHTING SHIP**, with class notation **1a**.

11.11.1.6 Detailed requirements concerning particular notations are specified in this section as below.

11.11.2 General requirements

11.11.2.1 Classification documentation, in addition to that required in 1.3.1, 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.

11.11.2.2 After fitting onboard, ships and fire-fighting 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;
.8 checking the searchlights operation.

11.11.2.3 Fire water pumps and their prime movers, as well as air compressors for charging the cylinders of the breathing apparatus shall be delivered with Test Certificate.

11.11.2.4 The following fire-fighting appliances and equipment shall be delivered 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.

11.11.2.5 Operation manual (booklet) containing the following information shall be available on board of each ship:
.1 instructions for the ship operation during all modes of fire- fighting and rescue operations;
.2 diagrams and operation description of all fire-fighting systems and systems control;
.3 instructions for use, periodical testing and maintenance of all fire-extinguishing systems and appliances.

11.11.3 Structural fire protection

11.11.3.1 All structural exterior boundaries of ships with class notation **1**, including exposed bulkheads, exposed decks and the hull above the lightest operating waterline are to be of steel construction and protected by a fixed water-spray system, as required in sec. 11.11.8.

11.11.3.2 All structural exterior boundaries of ships with class notation **2** or **3** are to be of steel but need not be protected by a fixed water-spray system nor internally insulated.

11.11.3.3 Doors and hatches in the structural exterior boundaries are to be of steel construction on all class notation.

11.11.3.4 Where a helicopter platform/deck is fitted, it should be arranged such that the structures do not interfere with the fire- fighting operation.

11.11.3.5 The materials of the platform and its supporting structures are, in general, to be of steel or equivalent materials.

11.11.3.6 At the discretion of PRS, aluminum alloys helicopter platform/deck may be acceptable provided the following conditions are complied with:

.1 the helicopter platform/deck is not facing a fire- fighting side and protected by the ship's structures, or

.2 where the helicopter platform/deck is facing a fire-fighting side, the following conditions are to be met:

- aluminum alloys helicopter platform/deck are to be supported by a steel structure.
- aluminum alloys helicopter platform/deck and supporting structures are to be protected by a fixed water spray system. The required minimum water capacity is to be 10 lt/min/m^2.
- helicopter platform/deck operation is not to take place when ship is in fire- fighting mode.
- helicopter is not to be on the deck during fire- fighting mode.
- a drainage system made of steel is to be provided to collect fuel spills and direct them to a safe location, independent of deckhouse.

11.11.3.7 Access/egress stairways and walkways to helidecks are to be made of steel.

11.11.3.8 Windows/portlights in the structural exterior boundaries are to be constructed to "A-0"class standard or be protected by external, steel deadlights or shutters, except in the navigation bridge. For ships equipped with a water-spray system meeting the requirements of 1.8, standard-type (non-fire rated) windows and portlights in the structural exterior boundaries are acceptable without external steel deadlights or shutters. The frames are to be metallic and effectively secured to the adjacent structure.

11.11.4 Requirements for equipment of the ships

11.11.4.1 The following Table 11.11.4 summarizes the minimum requirements for all classes of Fire Fighting ships:

Table 11.11.4

Item	Requirement	Class notation			
		1a	1	2	3
1	Number of water monitors[1)]	2	2	2 or 3 or 4	4
2	Discharge rate per monitor [m^3/h]	90	1200	3600 or 2400 or 1800	2400
3	Number of water pumps	1	1÷2	2÷4	2÷4
4	Total capacity of water pumps [m^3/h]	600	2400	7200	9600
5	Monitor range[2)] [m]	-	120	150	150

Item	Requirement	Class notation			
		1a	1	2	3
6	Monitor jet high[3] [m]	-	45	70	70
7	Number of hose connections (each side)	-	4	8	10
8	Number of fireman's outfits	-	4	8	10
9	Fuel oil capacity[4] [h]	-	24	96	96

Notes:

[1] The monitors are to be arranged so that the range and height of throw can be achieved with required number of monitors operating simultaneously towards a required direction.
[2] Measured horizontally from the monitor outlet to the mean impact area.
[3] Minimum height of the trajectory of water monitor jet measured vertically from sea level assuming a mean impact area located at a horizontal distance not less than 70 m from the nearest part of the fire- fighting ship.
[4] For continuous operation of all monitors in addition to the required capacity of the ship's fuel oil tanks..

11.11.5 Water monitors

11.11.5.1 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.

11.11.5.2 Water monitors are to be capable of being operated and maneuverer both locally and at the remote-control station. The monitor remote-control station is to have adequate overall operational visibility, including that of the water trajectory elevation, means of communication and protection from heat and water spray, if applicable.

11.11.5.3 Means are to be provided to prevent monitor jets from impinging on ship structures and equipment.

11.11.5.4 Control systems are to be suitably protected from external damage. Electrical control systems are to be provided with overload and short circuit protection. Hydraulic or pneumatic monitor control systems are to be duplicated. Shut-off and control equipment are to be clearly marked.

11.11.5.5 Water monitors shall give solid jets of water. In ships with **2** and **3** class notations, at least two monitors shall be capable of giving dispersed water jet.

11.11.5.6 The remote control station shall be fitted with water pumps control buttons, pressure gauges or another indicator (e.g. an electric diode) indicating pump operation and shut-off control valves.

11.11.5.7 Valves control shall be so designed as to avoid water hammer.

11.11.6 Pumps and piping systems

11.11.6.1 Fire- fighting pumps used for fire-fighting water monitors are to be solely for fire-fighting (including operating fire hose stations as permitted in 11.11.7) and self-protecting water spray (if applicable). Each pump is to be provided with its own dedicated, independent sea suction.

11.11.6.2 Where the fire monitor pumps are used also for water supply to water spray system and/or fire hose stations, the total capacity of the pumps is to be sized to ensure sufficient water supply for all connected services to be performed simultaneously.

11.11.6.3 Internal combustion or electric prime movers and gearboxes associated with the fire-fighting pumps are to meet the requirements of *Part VII*, as applicable.

11.11.6.4 Sea chests for fire- fighting are not to be used for any other purposes. All sea water inlets at sea chests are to be fitted with strainer plates at the ship's shell. The strainer plates are to have a clear area of at least twice that of the sea valves.

11.11.6.5 Each sea water inlet for fire-fighting is to be equipped with a shut off valve. The fire-fighting pump, the sea water shut off valve and the sea water discharge valve are to be operable from the same locations. Starting of the fire- fighting pump when the shut off valve is closed is to be prevented by providing either an interlock system or by audible and visual alarms.

11.11.6.6 Piping system shall be protected against overpressure.

11.11.6.7 All piping shall be made of steel and shall be protected both internally and externally against corrosion by hot galvanizing.

11.11.6.8 Drain plugs for water drainage shall be installed in the lowest section of the piping.

11.11.6.9 The piping system shall have arrangements to avoid overheating of the pumps at low delivery application rates.

11.11.6.10 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.

11.11.7 Fire hose stations

11.11.7.1 Each hose station nozzle is to be able to produce a jet or spray. Hoses are to be not less than 38 mm nor more than 65 mm in diameter, and generally are to be 20 m in length. At least half the total number of hose connections required in 11.11.4 are to be operated simultaneously with a pressure capable of producing a water jet flow of at least 12 m.

11.11.7.2 Hose stations are to be located on the weather deck and provided on each side of the ship in accordance with 11.11.4. The number of hoses required, in addition to the number of hoses required for normal onboard firefighting use, is to be the same as the number of hose connections required in 11.11.4. The number of nozzles required, in addition to the number of nozzles required for normal onboard firefighting use, is to be half of the total number of hose connections required in 11.11.4.

11.11.7.3 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.

11.11.8 Self-protection of ship with class notation 1

11.11.8.1 A fixed water-spray system is to provide protection for all exposed decks and external vertical areas of the hull, superstructure and deckhouses, life rafts, life boats, rescue boats, and their launching appliances, water monitor foundations and equipment associated with the water monitors. All the water-spray system piping, valves and nozzles are to be suitably protected from damage during fire-fighting operations.

11.11.8.2 During water- spray system operation, proper visibility from the navigation bridge and from fire control room shall be provided.

11.11.8.3 The minimum water capacity for the spray system is to be:

- 10 ltr/min/m^2 for vertical steel areas (non-insulated) and 5 lt/min/m^2 for vertical areas insulated to standard "A-60".
- 5 ltr/min/m^2 for horizontal steel areas (non-insulated); no requirement for exposed deck insulated to standard "A-60".
- 10 ltr/min/m^2 for wood sheathed steel decks.

11.11.8.4 If the water monitor pumps are used, they are to be provided with sufficient capacity to provide pressure and volume for both water monitors and water-spray systems.

11.11.8.5 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.

11.11.8.6 For ships which are fitted with a dynamic positioning system which is capable of automatically maintaining the position and heading of the ship under specified maximum environmental conditions having an independent centralized manual position control with automatic heading control, the minimum capacity of the water spray system may be based on the maximum areas which may be exposed to the fire, provided the water-spray system is divided into zones so that those areas which are not exposed to radiant heat can be isolated.

11.11.8.7 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.

11.11.8.8 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.

11.11.8.9 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.

11.11.8.10 Decks shall be provided with scuppers for water draining during water screen system operation.

11.11.9 Foam generators for ships of class notation 2 and 3

11.11.9.1 Mobile, high expansion foam generators for fire-fighting of minimum capacity 100 m^3/min are to be provided. The total volume of foam forming liquid carried onboard the ship is to provide of at least 30 minutes foam production.

11.11.9.2 Foam forming liquid shall be stored in portable tanks.

11.11.10 Foam monitor for ships of class notation 3

11.11.10.1 Two (2) fixed, low expansion foam monitors are to be provided in addition to the required water monitors and mobile foam generators.

11.11.10.2 Each foam monitor is to have a minimum capacity of 5000 lt/min with a foam expansion ratio of 15 to 1 and is to be capable for a height of throw of 50 m above the sea level, with both foam monitors in simultaneous operation at maximum foam output.

11.11.10.3 The fixed foam monitor system is to be fitted with dedicated foam concentration tank, foam mixing unit and pipelines to the foam monitors. The foam concentration tank is to have a minimum capacity for 30 minutes foam production at an assumed admixture of 5 percent. The water supply may be taken from the water monitor pumps.

11.11.10.4 The fixed foam monitors are to have both local (manual) and remote control. The remote control of the foam monitors is to be located at the remote-control station for the water monitors and is to include remote control of water and foam concentrate.

11.11.10.5 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.

11.11.10.6 Water supply to the foam monitor system may be taken from the water monitor system pumps after appropriately reducing the supply water pressure.

11.11.11 Fireman's outfits

11.11.11.1 Fireman's outfits shall consist of personal equipment and breathing apparatus, with two spare air bottles, complying with the requirements specified in sub-chapter 5.4.

11.11.11.2 The number of fireman's outfits in Table 11.11.4 -shall be addition to those required by sub-chapter 6.7.

11.11.11.3 Fireman's outfits shall be stored in room which shall be accessible from the open deck. The room shall be provided with ventilation and heating arrangements.

11.11.11.4 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.

11.11.12 Air recharging compressor

11.11.12.1 An air compressor capable of recharging the air bottles used in breathing apparatus of fireman's outfits required in 11.11.11 is to be provided.

11.11.12.2 The air compressor is to be capable of recharging all of the air bottles of the fireman's outfits required in 11.11.4 within a time not exceeding 30 minutes.

11.11.12.3 Air intake and air treatment system for compressor is to be capable to provide air with a quality according to the standard recognized by PRS.

11.11.12.4 Means for testing of the compressed air quality are to be available onboard.

11.11.13 Ships lighting, searchlights and CCTV vision systems

11.11.13.1 Ships lighting shall be such as to facilitate fire-fighting and rescue operations at night.

11.11.13.2 Two (2) searchlights are to be provided on all fire- fighting ships to facilitate fire-fighting operations at night, offering an effective horizontal and vertical range of coverage.

11.11.13.3 The searchlights are to provide an illumination to a distance of 250 m in clear air at a minimum level of illumination of 50 lux within an area of not less than 11 m diameter.

11.11.13.4 In case where additional dedicated marine CCTV or IR vision systems are installed onboard to facilitate fire-fighting operations at night or during adverse lighting conditions their operation must be controlled from the bridge.

11.11.14 Seakeeping/Stability

11.11.14.1 Thrusters and the ship's propulsion machinery are to be able to maintain the ship on position in still water during all combinations of operation and capacity of the water monitors, at not more than 80 percent of available propulsion force in any direction.

11.11.14.2 Adequate operating control systems are to be provided for fire-fighting operations which are to include an alarm condition at 80 percent of available propulsion power and automatic reduction of power action at 100 percent available propulsion power to prevent sudden or complete loss of power due to power overload.

11.11.14.3 Each ship is to have adequate stability for all loading conditions, with all fire-fighting monitors operating at maximum output multiplied by a factor of 1.1 in the direction most unfavourable to the stability of the ship. The heeling moment due to the operation of all fire-fighting monitors and thrusters is to be converted to a heeling arm, and superimposed on the righting arm curve of each loading condition.

11.11.15 Fire- fighting ships operating in ice conditions

Special consideration is to be given to class notation **1** of the ships intended for fire- fighting service operation in ice conditions, due to the danger to ship stability from the ice accretion on the outer surfaces resulting from the self-protecting water spray. Such ships, built in compliance with all requirements for class notation **1** but not equipped with water spray protection, can still be considered as provided with the same fire-fighting capabilities as class **1**, but not considered suitable for close operation during early stages of firefighting.

11.12 Special purpose ships – additional marks: SPECIAL PURPOSE SHIP, CREW BOAT, RESEARCH SHIP, TRAINING SHIP

11.12.1 Fire protection

11.12.1.1 For ships carrying more than 240 persons on board, the requirements of this *Part V* (SOLAS chapter II-2) for passenger ships carrying more than 36 passengers shall be applied. (SPS Code Ch. 6.1)

11.12.1.2 For ships carrying more than 60 (but not more than 240) persons on board, the requirements of this *Part V* (SOLAS chapter II-2) for passenger ships carrying not more than 36 passengers shall be applied. (SPS Code Ch. 6.2)

11.12.1.3 For ships carrying not more than 60 persons on board, the requirements of this *Part V* (SOLAS chapter II-2) for cargo ships shall be applied. (SPS Code Ch. 6.3)

11.12.2 Carriage of dangerous goods

If ships are intended to carry dangerous goods, they shall comply with requirements of chapter 7 of this *Part V* (SPS Code, Ch.7).

11.12.3 Store-rooms for explosives

11.12.3.1 In special purpose ships, the arrangement of store-rooms for explosives may be made, provided the requirements of this sec.11.12.2 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^3 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^3.

11.12.3.2 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.

11.12.3.3 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.

11.12.3.4 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 11.12.2.2 and 11.12.2.3.

11.12.3.5 Self-contained store-rooms and boxes for explosives shall be located on the open deck in protected places.

11.12.3.6 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.

11.12.3.7 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.

11.12.3.8 Only pipelines of fresh water, sea water and bilge systems may be run through store-rooms for explosives.

11.12.3.9 Pipelines of other installations may be run through the store-rooms, provided they are encased in a watertight duct.

11.12.3.10 Doors and covers of store-rooms shall be provided with means enabling them to be locked.

11.12.3.11 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.

11.12.3.12 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.

11.12.3.13 The floor of store-rooms shall be covered with permanent, antislip material precluding spark formation, such as floor-mats.

11.12.3.14 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 not be less than one cubic metre per each 100 kg of explosives or 1000 detonating fuses.

11.12.3.15 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 38ºC. Openings of this ventilation shall be provided with flame arresters.

11.12.3.16 Portable store-rooms shall be provided with an effective natural ventilation, the inlet and outlet openings of the ventilation being fitted with flame arresters.

11.12.3.17 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.

11.12.3.18 Built-in and portable store-rooms for explosives shall be fitted with water-spraying system in accordance with the requirements specified in sub-chapter 3.4. Control devices shall be clearly marked.

11.12.3.19 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.

11.12.3.20 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.

11.12.3.21 Boxes for the stowage of explosives shall be watertight and constructed of metal. The thickness of the walls and cover of the boxes shall not be less than 3 mm. Surfaces exposed to a direct solar radiation shall be provided with a protective screen.

11.12.3.22 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.

11.12.3.23 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.

11.12.3.24 Special rooms shall be provided for the stowage of fuses.

11.12.3.25 Electrical equipment of the store-rooms for explosives shall fulfil the requirements of *Part VIII*, sec.22.5.3.

11.12.4 Fire detection and fire alarm system

11.12.4.1 Fire detection and fire alarm system shall be provided in ships of 1000 gross tonnage and upwards and in the case when method IIIC of fire protection is applied – also in ships of 500 gross tonnage and upwards.

11.12.4.2 In spaces fitted with automatic sprinkler system, fire detection and fire alarm system need not be provided.

11.12.4.3 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.

11.12.4.4 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^2;
- **.4** machinery spaces of category A and main control stations;
- **.5** industrial spaces.

11.13 Industrial personnel transfer vessel – additional mark: IP SHIP

Fire protection requirements – see *Publication 12/P*.

11.14 Fishing vessels – additional mark: FISHING VESSEL

11.14.1 Fire protection of fishing vessels of 24 meters in length and more flying the flag of an EU Member State and registered in the community, or operating in the territorial waters or territorial sea of an EU Member State, or landing their catch in the port of an EU Member State shall comply with the applicable requirements specified in Directive 97/70/EC as further amended through Directive 2002/35/EC.

11.14.2 Fire protection of fishing vessels of 24 meters in length and more other than those specified in 11.13.1 shall comply with the applicable requirements specified in *Torremolinos International Convention for the Safety of Fishing Vessels 1977* and in the *Torremolinos Protocol* relating to the Convention.

11.14.3 Fishing vessels need not comply with the SOLAS requirements specified in this *Part V*.

11.15 Offshore vessels – additional marks: TUG, SUPPLY VESSEL

There is no additional requirements for fire protection.

11.16 Other ship types – additional marks: DREDGER, HOPPER BARGE, BARGE, FLOATING CRANE, LIVESTOCK CARRIER, REEFER CARRIER, PONTOON

11.16.1 Requirements for LIVESTOCK CARRIERS

11.16.1.1 Fire protection of cargo spaces

11.16.1.1.1 Fixed gas fire-extinguishing system is not required to be used in the cargo spaces with livestock stalls.

11.16.1.1.2 If combustible materials are used in the cargo spaces, the spaces shall be equipped with a fixed fire detection and alarm system, complying with relevant requirements of, sub-chapter 4.1 provided with smoke detectors and manually operated call points.

11.16.1.2 Water fire main system

The system shall comply with the below additional requirements:

11.16.1.2.1 The water fire main system shall be permanently pressurized and shall be so constructed that it is capable of immediate delivering at least one efficient extinguishing jet of water from any hydrant placed inside cargo spaces and is capable of continuous water supply by automatic start of one of required fire pumps.

11.16.1.2.2 Hydrant valves shall be so arranged that at least two jets of water from separate hydrants can simultaneously reach each part containing livestock stalls. One of those jets of water shall be delivered by a single fire hose. The fire hoses shall be all the time connected to hydrant valves.

11.16.1.2.3 The hydrant valves shall be so arranged that two extinguishing jets of water can reach one place, without leading hoses through or over the livestock stalls.

11.16.1.2.4 Water nozzles shall be of dual-purpose (spray and jet) type.

11.16.1.3 Portable fire-extinguishers

If straw and hay are used in the livestock spaces, water portable extinguishers of an approved type shall be placed in the pathways between the stalls, so arranged that one extinguisher is placed per each 18 m of the spaces length. One extinguisher shall be placed at the entrance to the spaces.

Instead of portable extinguishers other water-based extinguishing system is allowed to be used.

CHAPTER 12

12 ADDITIONAL REQUIREMENTS FOR SPECIFIC STRUCTURES, SYSTEMS OR EQUIPMENT

12.1 Catamarans

There are no additional requirements with regard to fire protection of such ships.

12.2 Ships operating in ice – additional marks of Baltic ice class: L1A, L1, L2, L3, (L4), additional marks of Polar class – PC1, PC2, PC2, PC3, PC4, PC5, PC6, PC7

12.2.1 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.

12.2.2 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.

12.2.3 Water Fire-Extinguishing Systems

12.2.3.1 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 this *Part V*, is to be connected to a sea chest which is provided with de-icing arrangements, complying with the requirements of *Publication 122/P*. (IACS UR F41)

12.2.3.2 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.

12.2.3.3 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.

12.2.3.4 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.

12.2.3.5 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.

12.2.3.6 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.

12.2.3.7 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.

12.2.4 Fixed Gas Fire-Extinguishing Systems

12.2.4.1 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.

12.2.4.2 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.

12.2.4.3 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.

12.2.4.4 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.

12.2.5 Fire-Fighting Equipment

Foam/ water mist fire-extinguishers shall not be located in any positions that are exposed to freezing temperatures.

12.2.6 Requirements for Polar ships – additional marks: PC1, PC2, PC3, PC4, PC5, PC 6, PC7

Ships intended to operate in polar waters as defined in *Polar Code*, with respect to fire protection, should meet the requirements specified in the *Polar Code*, Chapter 7.

12.3 Hull strengthening and movable hull structures – additional marks: SD, LAL, MD

There are no additional requirements with regard to fire protection of such ships.

12.4 Carriage of cargo on open deck – additional marks: ACC (...), TIMBER

There are no additional requirements with regard to fire protection of such ships.

12.5 Periodically unattended machinery spaces – additional marks: AUT, NAV1

12.5.1 General

12.5.1.1 The arrangements provided shall be such as to ensure that the safety of the ship in all sailing conditions, including manoeuvring, is equivalent to that of a ship having the machinery spaces manned. (SOLAS II-1/46.1)

12.5.1.2 Measures shall be taken to the satisfaction of the Administration to ensure that the equipment is functioning in a reliable manner and that satisfactory arrangements are made for regular inspections and routine tests to ensure continuous reliable operation. (SOLAS II-1/46.2)

12.5.1.3 Every ship shall be provided with documentary evidence, to the satisfaction of the Administration, of its fitness to operate with periodically unattended machinery spaces. (SOLAS II-1/46.3)

12.5.2 Special consideration in respect of passenger ships

Passenger ships shall be specially considered by the Administration as to whether or not their machinery spaces may be periodically unattended and if so whether additional requirements to those stipulated in these Regulations are necessary to achieve equivalent safety to that of normally attended machinery spaces. (SOLAS II-1/54)

12.5.3 Water fire main system

12.5.3.1 Ready availability of water supply

The arrangements for the ready availability of water supply shall be:

.1 in passenger ships:

- if fitted with periodically unattended machinery spaces in accordance with SOLAS reg. II-1/54, the Administration shall determine provisions for fixed water fire-extinguishing arrangement for such spaces equivalent to those required for normally attended machinery spaces.

.2 in cargo 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 permanent pressurization of the fire main system by one of the main fire pumps, except that the Administration may waive this requirement for cargo ships of less than 1,600 gross tonnage if the fire pump starting arrangement in the machinery space is in an easily accessible position. (SOLAS II-2/10.2.1.2)

12.5.4 Machinery spaces containing steam turbines or enclosed steam engines

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 fire-extinguishing systems specified in par. 6.2.1.1 (SOLAS par. 10.4.1) shall be provided if such spaces are periodically unattended. (SOLAS II-2/10.5.3.1)

12.5.5 Fixed local application fire-fighting systems

In the case of periodically unattended machinery spaces, the fire-fighting system, required by par. 6.2.7.2 shall have both automatic and manual release capabilities. (SOLAS II-2/10.5.6.2)

12.5.6 Early detection of fire in machinery spaces

12.5.6.1 Means shall be provided to detect and give alarms at an early stage in case of fires:

.1 in boiler air supply casings and exhausts (uptakes); and

.2 in scavenging air belts of propulsion machinery, unless the Administration considers this to be unnecessary in a particular case. (SOLAS II-1/47.1)

12.5.6.2 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**. (SOLAS II-1/47.2)

IACS interpretations

* *The wording "or engine bearing temperature monitors" is understood to include all bearings i.e. journal and connecting rod bearings.* (UI SC76)

** *An equivalent device could be interpreted as measures applied to high speed engines where specific design features to preclude the risk of crankcase explosions are incorporated.* (UI SC133)

12.5.7 Fire detection system for unattended machinery spaces

12.5.7.1 An automatic fire detection system, complying with the applicable requirements specified in sub-chapter 4.1 and in this sec. 12.5.7, is to be fitted in periodically unattended machinery spaces of category A. (UR F32.1, SOLAS II-2/7.4.1.1)

12.5.7.2 The system is to be designed with self-monitoring properties. Power or system failures are to initiate an audible alarm distinguishable from the fire alarm. (UR F32.2)

12.5.7.3 The fire detection indicating panel is to be located on the navigating bridge, fire control station, or other accessible place where a fire in the machinery space will not render it inoperative. (UR F32.3)

12.5.7.4 The fire detection indicating panel is to 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. (UR F32.4)

12.5.7.5 Fire detectors are to be of types, and so located, that they will rapidly detect the onset of fire in conditions normally present in the machinery space. Consideration is to be given to avoiding false alarms. The type and location of detectors are to be approved by the Classification Society and a combination of detector types is recommended in order to enable the system to react to more than one type of fire symptom. (UR F32.5)

12.5.7.6 Fire detector zones are to be arranged in a manner that will enable the operating staff to locate the seat of the fire. The arrangement and the number of loops and the location of detector heads is to be approved in each case. Air currents created by the machinery are not to render the detection system ineffective. (UR F32.6)

12.5.7.7 When fire detectors are provided with the means to adjust their sensitivity, necessary arrangements are to be ensured to fix and identify the set point. (UR F32.7)

12.5.7.8 When it is intended that a particular loop or detector is to be temporarily switched off, this state is to be clearly indicated. Reactivation of the loop or detector is to be performed automatically after a present time. (UR F32.8)

12.5.7.9 The fire detection indicating panel is to be provided with facilities for functional testing. (UR F32.9)

12.5.7.10 The fire detecting system shall be fed automatically from the emergency source of power by a separate feeder if the main source of power fails. (UR F32.10)

12.5.7.11 Facilities are to be provided in the fire detecting system to release manually the fire alarm from the following places:

- passageways having entrances to engine and boiler rooms,
- navigating bridge,
- control station in engine room. (UR F32.11)

12.5.7.12 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. (UR F32.12)

12.5.7.13 With regard to power supply, safety devices, selection and routing of cables, fire detection and alarm system shall fulfil the requirements specified in *Part VIII,* sub-chapter 7.5.

12.5.8 Means of escape from machinery spaces on passenger ships

12.5.8.1 Dispensation from two means of escape

In a ship of 1,000 gross tonnage and above, the Administration may dispense with one means of escape from any such space, including a normally unattended auxiliary machinery space, 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. (SOLAS II-2/13.4.1.3)

12.5.9 Means of control in periodically unattended machinery spaces

12.5.9.1 For periodically unattended machinery spaces, the Administration shall give special consideration to maintaining the fire integrity of the machinery spaces, the location and centralization of the fire-extinguishing system controls, the required shutdown arrangements (e.g. ventilation, fuel pumps, etc.) and that additional fire-extinguishing appliances and other fire-fighting equipment and breathing apparatus may be required. (SOLAS II-2/5.2.3.1)

12.5.9.2 In passenger ships, these requirements shall be at least equivalent to those of machinery spaces normally attended. (SOLAS II-2/5.2.3.2)

12.6 Dynamic positioning – additional marks: DP1, DP2, DP2+, DP3

There are no additional requirements with regard to fire protection of such ships.

12.7 Ships supporting underwater works – additional marks: DIV SSS, DIV SSA, DIV SSB, Transferable DIV SSS, Transferable DIV SSA, Transferable DIV SSB

There are no additional requirements with regard to fire protection of such ships.

12.8 Helicopter landing arrangements – additional mark: HLA

12.8.1 Helicopter facilities

12.8.1.1 Application

12.8.1.1.1 Depending on helicopter operation, ships shall be provided with specially designated and equipped areas: helideck, helicopter landing area or winching area, defined in sec. 12.8.2.

12.8.1.1.2 In addition to complying with appropriate requirements of this *Part V*, (SOLAS regulations in parts B, C, D and E, as appropriate), ships equipped with helidecks shall comply with the requirements of this sub-chapter 12.8 (regulation). (SOLAS II-2/18.2.1)

12.8.1.1.3 Where helicopters land or conduct winching operations on an occasional or emergency basis on ships without helidecks, fire- fighting equipment fitted in accordance with the requirements of this *Part V* (SOLAS, Part C) may be used. This equipment shall be made readily available in close proximity to the landing or winching areas during helicopter operations. (SOLAS II-2/18.2.2)

12.8.1.1.4 Notwithstanding the requirements of par. 12.8.1.1.3 (SOLAS par. 2.2) above, ships, having a helicopter landing area, shall be provided with foam firefighting appliances which comply with the relevant provisions of sec.12.8.7 (chapter 17 of the Fire Safety Systems Code) (SOLAS II-2/18.2.3)

12.8.1.1.5 Notwithstanding the requirements of par. 12.8.1.1.3 or 12.8.1.1.4 (SOLAS par.2.2 or 2.3) above, ro-ro passenger ships without helidecks shall comply with SOLAS reg. III/28. (SOLAS II-2/18.2.4)

12.8.1.1.6 Ro-ro passenger ships provided with helicopter landing area*, shall comply with the requirements of sec. 12.8.7 and shall be equipped with fire-fighting appliances and rescue equipment, listed in sec. 12.8.6.2. Required equipment shall be made readily available in close proximity to the landing areas during helicopter operations. (MSC/Circ.895, par.4)

* Recommendation on helicopter landing area for ro-ro passenger ships are given in MSC/Circ.895 and MSC.1/Circ.1524.

12.8.1.1.7 Ro-ro passenger ships provided with a winching area shall be fitted with portable fire-fighting equipment, as follows: at least one mobile dry powder extinguisher having a total capacity of not less than 45 kg and carbon dioxide fire-extinguishers of a total capacity not less than 18 kg or equivalent. This equipment shall be made readily available in close proximity to the winching areas during helicopter operations.

12.8.2 Definitions

For the purposes of this sub-chapter 12.8, the following definitions apply:

.1 *D-value* – the largest dimension of the helicopter used for assessment of the helideck when its rotors are turning. It establishes the required area of foam application. (FSS Code Ch. 17.2.1)

.2 ***Deck integrated foam nozzles*** – foam nozzles recessed into or edge mounted on the helideck. (FSS Code Ch. 17.2.2)

.3 ***Foam-making branch pipes*** – air-aspirating nozzles in tube shape for producing and discharging foam, usually in straight stream only. (FSS Code Ch. 17.2.3)

.4 ***Helicopter landing area*** – an area on a ship designated for occasional or emergency landing of helicopter and not designed for routine helicopter operations. (FSS Code Ch. 17.2.4)

.5 ***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 helicopters. (FSS Code Ch. 17.2.5)

.6 ***Hose reel foam station*** – a rigid hose reel equipped with air-foam nozzles, together with a fixed proportioner and foam concentrate storage tank, fitted on the common frame. (FSS Code Ch. 17.2.6)

.7 ***Monitor foam station*** – a foam monitor, either self-inducing, or together with separate fixed foam proportioner, and fixed foam concentrate tank, mounted on a common frame. (FSS Code Ch. 17.2.7)

.8 ***Obstacle free sector*** – the take-off and approach sector which totally encompasses the safe landing area and extends over a sector of at least 210º, within which only specified obstacles are permitted. (FSS Code Ch. 17.2.8)

.9 ***Limited obstacle sector*** – a 150º sector outside the take-off and approach sector that extends outward from a helideck where objects of limited height are permitted. (FSS Code Ch. 17.2.9)

.10 ***Winching area*** – a pick-up area provided for the transfer by helicopter of personnel or stores to or from the ship, while the helicopter hovers above the deck. (SOLAS II-2/3.58)

.11 ***Helicopter facilities*** – a helideck including any refueling and hangar facilities. (SOLAS II-2/3.27)

12.8.3 Structure

12.8.3.1 Construction of steel or other equivalent material

In general, the construction of the helideck shall be 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. (SOLAS II-2/18.3.1)

12.8.3.2 Construction of aluminium or other low melting point metals

If the Administration permits aluminium or other low melting point metal construction that is not made equivalent to steel, the following provisions shall be satisfied:

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

.2 if the platform is located above the ship' s deckhouse or similar structure, the following conditions shall be satisfied:

.2.1 the deckhouse top and bulkheads under the platform shall have no openings;

.2.2 all windows under the platform shall be provided with steel covers; and

.2.3 after each fire on the platform or in close proximity, the platform shall undergo a structural analysis to determine its suitability for further use. (SOLAS II-2/18.3.2)

12.8.4 Means of escape

A helideck shall be provided with both a main and an emergency means of escape and access for fire-fighting and rescue personnel. These shall be located as far apart from each other as is practicable and preferably on opposite sides of the helideck. (SOLAS II-2/18.4)

12.8.5 Drainage facilities

Drainage facilities in way of helidecks shall be constructed of steel and shall lead directly overboard independent of any other system and shall be designed so that drainage does not fall onto any part of the ship. (SOLAS II-2/18.6)

12.8.6 Fire protection of helideck

12.8.6.1 Fixed foam system

Helideck shall be fitted with a fixed foam system complying with the requirements of 12.8.8. (SOLAS II-2/18.5.1.6)

12.8.6.2 Fire-fighting appliances and rescue equipment

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

.1 at least two mobile dry-powder extinguishers having a total capacity of not less than 45 kg; (SOLAS II-2/18.5.1.1, MSC/Circ.895, par.4.1)

.2 carbon dioxide fire-extinguishers of a total capacity not less than 18 kg or equivalent; (SOLAS II-2/18.5.1.2, MSC/Circ.895, par.4.2)

.3 two sets of fire-fighter's outfits, complying with sec. 5.1.4, in addition to those required elsewhere in this *Part V*; (SOLAS II-2/18.5.1.2, MSC/Circ.895, par.4.6)

.4 at least one rescue kit, stored in a manner that provides for immediate use and protection against weather conditions, consisting of the elements:

- adjustable wrench;
- blanket, fire-resistant;
- steel cutters, bolt 60 cm;
- hook, grab or salving;
- hacksaw, heavy duty, complete with 6 spare blades;
- ladder;
- lift line 5 mm in diameter and 15 m in length;
- pliers, side-cutting;
- set of assorted screwdrivers; and
- harness knife complete with sheath. (SOLAS II-2/18.5.1.2, MSC/Circ.895, par.4.7)

12.8.7 Fire protection of helicopter landing area

12.8.7.1 For helicopter landing areas, at least two portable foam applicator units, or at least two hose reel foam stations, complying with appropriate requirements of sec. 12.8.8, shall be provided, each capable of discharging a minimum foam solution discharge rate, depending on helicopter category, in accordance with Table 12.8.8. (FSS Code Ch. 17.3.4)

12.8.7.2 The quantity of foam concentrate shall be adequate to allow operation of all connected discharge devices for at least 10 min. For tankers fitted with a deck foam system, the Administration may consider an alternative arrangement, taking into account the type of foam concentrate to be used. (FSS Code Ch. 17.3.4)

12.8.8 Foam fire-extinguishing system for the helideck

12.8.8.1 The system shall be capable of manual release, and may be arranged for automatic release. (FSS Code Ch. 17.3.1)

12.8.8.2 For helidecks, the foam system shall contain either at least two fixed foam monitors (monitor foam stations), or deck integrated foam nozzles. (FSS Code Ch. 17.3.2)

12.8.8.3 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. (FSS Code Ch. 17.3.2)

12.8.8.4 For the systems with foam monitors, depending on helicopter category, the minimum foam concentrate solution discharge rate shall be determined by multiplying the D-value area, given in Table 12.8.8, by 6 *l*/min/m². (FSS Code Ch. 17.3.2)

Table 12.8.8

Category	Helicopter overall length (D-value)	Minimum foam solution discharge rate [*l*/min]
H1	up to but not including 15 m	250
H2	from 15 m up to but not including 24 m	500
H3	from 24 m up to but not including 35 m	800

12.8.8.5 For the systems with deck integrated foam nozzle, the minimum foam concentrate solution discharge rate shall be determined by multiplying the overall helideck area by 6 *l*/min/m². (FSS Code Ch. 17.3.2)

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

12.8.8.7 The minimum discharge rate of each hose reel shall be at least 400 *l*/min. (FSS Code Ch. 17.3.2)

12.8.8.8 The quantity of foam concentrate shall be adequate to allow operation of all connected discharge devices for at least 5 min. (FSS Code Ch. 17.3.2)

12.8.8.9 Where foam monitors are installed, 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. (FSS Code Ch. 17.3.3)

12.8.8.10 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. (FSS Code Ch. 17.3.5)

12.8.8.11 Activation of any manual release station shall initiate the flow of foam solution to all connected hose reels, monitors and deck integrated foam nozzles. (FSS Code Ch. 17.3.6)

12.8.8.12 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, and shall be manufactured and tested to the satisfaction of the Administration. (FSS Code Ch. 17.3.7)

12.8.8.13 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 to the satisfaction of the Administration, based on tests that demonstrate the nozzle's capability to extinguish fires involving the largest size helicopter for which the helideck is designed. (FSS Code Ch. 17.3.8)

12.8.8.14 Monitors, foam-making branch pipes, deck integrated foam nozzles and couplings shall be constructed of brass, bronze or stainless steel. Piping, fittings and related components, except gaskets, shall be designed to withstand exposure to temperatures up to 925°C. (FSS Code Ch. 17.3.9)

12.8.8.15 The principal agent shall be suitable for use with salt water. (SOLAS II-2/18.5.1.4) The foam concentrate shall be demonstrated effective for extinguishing aviation fuel spill fires and shall conform to performance standards not inferior to those acceptable to the Organization.* Where the foam storage tank is on the exposed deck, freeze protected foam concentrates shall be used, if appropriate, for the area of operation. (FSS Code Ch. 17.3.10)

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* Refer to *the International Civil Aviation Organization Airport Services Manual*, part 1, Rescue and Fire Fighting, chapter 8, Extinguishing Agent Characteristics, paragraph 8.1.5, Foam specifications table 8-1, Performance Level B, or to the *Revised Guidelines for the performance and testing criteria, and surveys of foam concentrates for fixed fire-extinguishing systems* -MSC.1/Circ.1312.

12.8.8.16 Any foam system equipment installed within the take-off and approach obstacle free sector shall not exceed a height of 0.25 m. Any foam system equipment installed in the limited obstacle sector shall not exceed the height permitted for objects in this area. (FSS Code Ch. 17.3.11)

12.8.8.17 All manual release stations, monitor foam stations, hose reel foam stations, hose reels and monitors shall be provided with a means of access that does not require travel across the helideck or helicopter landing area. (FSS Code Ch. 17.3.12)

12.8.8.18 Oscillating monitors, if used, shall be pre-set to discharge foam in spray pattern and have a means of disengaging the oscillating mechanism to allow rapid conversion to manual operation. (FSS Code Ch. 17.3.13)

12.8.8.19 If foam monitor with flow rate up to 1,000 *l*/min is installed, it shall be equipped with an 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. (foam branch pipes) 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 1,000 *l*/min are installed. If only portable foam applicators or hose reel stations are provided, these shall be equipped with an air-aspirating handline nozzles (foam branch pipes). (FSS Code Ch. 17.3.14)

12.8.8.20 Foam concentrate shall be stored in the tank located outside the helideck area, in the place protected from the damage.
The location of the foam concentrate storage tank should be indicated with the symbol used on *Fire Control Plan*.

12.8.8.21 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.

12.8.9 Helicopter refueling and hangar facilities

Where the ship has helicopter refueling and hangar facilities, the following requirements shall be complied with:

.1 a designated area shall be provided for the storage of fuel tanks which shall be:
  .1.1 as remote as is practicable from accommodation spaces, escape routes and embarkation stations; and
  .1.2 isolated from areas containing a source of vapour ignition;

.2 the fuel storage area shall be provided with arrangements whereby fuel spillage may be collected and drained to a safe location;

.3 tanks and associated equipment shall be protected against physical damage and from a fire in an adjacent space or area;

.4 where portable fuel storage tanks are used, special attention shall be given to:
  .4.1 design of the tank for its intended purpose;
  .4.2 mounting and securing arrangements;
  .4.3 electric bonding; and
  .4.4 inspection procedures;

.5 storage tank fuel pumps shall be provided with means which permit shutdown from a safe remote location in the event of a fire. Where a gravity fueling system is installed, equivalent closing arrangements shall be provided to isolate the fuel source;

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

.7 electrical fuel pumping units and associated control equipment shall be of a type suitable for the location and potential hazards;
.8 fuel pumping units shall incorporate a device which will prevent over-pressurization of the delivery or filling hose;
.9 equipment used in refueling operations shall be electrically bonded;
.10 "NO SMOKING" signs shall be displayed at appropriate locations;
.11 hangar, refueling and maintenance facilities shall be treated as category "A" machinery spaces with regard to structural fire protection, fixed fire-extinguishing and detection system requirements;
.12 enclosed hangar facilities or enclosed spaces containing refuelling installations shall be provided with mechanical ventilation, as required by sec. 17.3.3 of *Part VI* (SOLAS reg. 20.3) complying with sub-chapter 11.9 of *Part VI* for closed ro-ro spaces of cargo ships. Ventilation fans shall be of non-sparking type; and
.13 electric equipment and wiring in enclosed hangar or enclosed spaces containing refueling installations shall comply with sec. 11.3.1.2.2 (SOLAS reg. 20.3.2, 20.3.3 and 20.3.4). (SOLAS II-2/18.7)

12.8.10 Operation manuals and fire-fighting service

12.8.10.1 Each helicopter facility shall have an *Operations Manual*, including a description and a checklist of safety precautions, procedures and equipment requirements. This manual may be part of the ship' s emergency response procedures. (SOLAS II-2/18.8.1)

12.8.10.2 The procedures and precautions to be followed during refueling operations shall be in accordance with recognized safe practices and contained in the *Operations Manual*. (SOLAS II-2/18.8.2)

12.8.10.3 Fire-fighting personnel consisting of at least two persons trained for rescue and fire-fighting duties and fire-fighting equipment shall be immediately available at all times when helicopter operations are expected. (SOLAS II-2/18.8.3)

12.8.10.4 Fire-fighting personnel shall be present during refueling operations. However, the fire-fighting personnel shall not be involved with refueling activities. (SOLAS II-2/18.8.4)

12.8.10.5 On-board refresher training shall be carried out and additional supplies of fire-fighting media shall be provided for training and testing of the equipment. (SOLAS II-2/18.8.5)

12.9 Ships using low-flashpoint fuels – additional mark: IGF DF

Fire protection for ships using low-flashpoint fuel receiving in their symbol of class additional mark IGF DF shall comply with the applicable requirements/ recommendations contained in:

- *Publication 72/P – ships using gas (LNG, CNG or LPG);*
- *Publication 37/I – ships using fuel cell power installations;*
- *Publication 38/I – ships using methyl/ethyl alcohol as fuel.*

12.10 Energy efficient ships – Marks: ECO SEA, ECO AIR, ECO EF, ECO BWM, ECO REC

There is no additional requirements for fire protection.

12.11 Other ship's features – Marks: IWS, PAC

There is no additional requirements for fire protection.

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 Additional fire safety measures related to the installation of ballast water management systems (BWMS) on-board ships

Requirements of sub-chapter 8.6 apply for existing ships, where the application for approval for the installation plans of BWMS is dated on or after 1 July 2022. (IACS UR F45, note 1)

ANNEX I – List of external reference documents

IMO documents

1. *HSC Code – International Code of Safety for High-Speed Craft, as amended.*
2. *IBC Code – International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk, as amended.*
3. *IGC Code – International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, as amended.*
4. *IGF Code – International Code of Safety for Ships using Gases or other Low flashpoint Fuels, as amended.*
5. *IMDG Code – International Maritime Dangerous Goods Code, as amended.*
6. *IMSBC Code – International Maritime Solid Bulk Cargoes Code, as amended.*
7. *Polar Code – International Code for Ships Operating in Polar Waters, as amended.*
8. *SOLAS Convention – International Convention for the Safety of Life at Sea, 1974, as amended.*

9. A.567(14): *Regulation for Inert Gas Systems on Chemical Tankers.*
10. A.654(16): *Graphical Symbols for Fire Control Plans.*
11. A.752(18): *Guidelines for the Evaluation, Testing and Application of Low-Location Lighting on Passenger Ships.*
12. A.753(18): *Guidelines for the Application of Plastic Pipes on Ships.*
13. 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.*
14. A.951(23): *Improved Guidelines for Marine Portable Fire Extinguishers.*
15. A.952(23): *Graphical Symbols for Shipboard Fire Control Plans.*
16. A.1021(26): *Code on Alerts and Indicators.*
17. A.1116(30): *Escape Route Signs and Equipment Location Markings*

18. MSC.313(88): *Amendments to the Guidelines for the Application of Plastic Pipes on Ships.*
19. MSC.399(95): *Amendments to the Guidelines for the Application of Plastic Pipes on Ships (Resolution A.753(18)), as amended by Resolution MSC.313(88).*
20. MSC.420(97): *Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk.*
21. MSC.429(98)/Rev.1, Reg. II-1/17.1, par.4
22. MEPC.269(68): *Guidelines for the Development of the Inventory of Hazardous Materials.*

23. MSC/Circ.353: *Revised Guidelines for Inert Gas Systems.*
24. MSC/Circ.387: *Revised Guidelines for Inert Gas Systems. (MSC/Circ.353).*
25. MSC/Circ.450/Rev.1: *Revised factors to be taken into consideration when designing cargo tanks venting and gas-freeing arrangements.*
26. MSC/Circ.451: *Guidance concerning the location of fire control plans for the assistance of the shore side fire-fighting personnel.*
27. MSC/Circ.553: *Information on flashpoint and recommended fire-fighting media for chemicals to which neither the IBC nor BCH Codes apply.*
28. MSC/Circ.670: *Guidelines for the performance and testing criteria and surveys of high-expansion foam concentrates for fixed fire-extinguishing systems.*
29. 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).*
30. MSC/Circ.731: *Revised factors to be taken into consideration when designing cargo tank venting and gas -freeing arrangements.*
31. MSC/Circ.735: *Recommendation on the design and operation of passenger ships to respond to elderly and disabled persons' needs.*
32. MSC/Circ.798: *Guidelines for performance and testing criteria and surveys of medium-expansion foam concentrate for fixed fire-extinguishing systems.*
33. MSC/Circ.849: *Guidelines for the performance, location, use and care of emergency escape breathing devices (EEBDs).*
34. MSC/Circ.895: *Recommendation on helicopter landing areas in ro-ro passenger ships.*
35. MSC/Circ.917/Corr.1: *Guidelines on fire safety construction in accommodation areas.*
36. MSC/Circ.1002/Corr.1/Corr.2/Corr.3: *Guidelines on alternative design and arrangements for fire safety (as amended by MSC.1/Circ.1552).*
37. MSC/Circ.1003: *Guidelines on a simplified calculation for the total amount of combustible materials per unit area in accommodation and service spaces.*

38. 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).*
39. MSC/Circ.1070: *Ship design, construction, repair and maintenance – Guidelines for the survey of repairs.*
40. MSC/Circ.1086: *Code of practice for atmospheric oil mist detectors.*
41. MSC/Circ.1120: *Unified interpretations of SOLAS Chapter II-2, the FSS Code, the FTP Code and related fire test procedures.*
42. MSC/Circ.1165: *Revised guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump-rooms.*
43. MSC/Circ.1167: *Functional requirements and performance standards for the assessment of evaluation guidance systems.*
44. 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.*
45. MSC.1/Circ.1239: *Unified interpretations of SOLAS Chapter II-2.*
46. MSC.1/Circ.1242: *Guidelines for the approval of fixed fire detection and fire alarm systems for cabin balconies.*
47. MSC.1/Circ.1266: *Carriage of dangerous goods.*
48. MSC.1/Circ.1269: *Amendments to the revised guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump-rooms (MSC/Circ.1165).*
49. MSC.1/Circ.1274: *Guidelines for evaluation of fire risk of external areas on passenger ships.*
50. MSC.1/Circ.1275/Corr.1: *Unified interpretation of SOLAS Chapter II-2 on the number and arrangement of portable fire extinguishers on board ships*
51. MSC.1/Circ.1276/*Rev.1*: *Unified interpretations of SOLAS Chapter II-2.*
52. MSC.1/Circ.1312/Corr.1: *Revised guidelines for the performance and testing criteria, and surveys of low-expansion foam concentrates for fixed-fire-extinguishing systems.*
53. MSC.1/Circ.1316: *Guidelines on determining the No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) values for halocarbon fire-extinguishing agents*
54. MSC.1/Circ.1318/Rev.1: *Guidelines for the maintenance and inspections of fixed carbon dioxide fire-extinguishing systems.*
55. MSC.1/Circ.1319: *Recommendation for the evaluation of fire performance and approval of large fire doors.*
56. MSC.1/Circ.1321: *Guidelines for measures to prevent fires in engine-rooms and cargo pump-rooms.*
57. 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).*
58. MSC.1/Circ.1368: *Interim clarifications of SOLAS Chapter II-2 requirements regarding interrelation between the central control station, navigation bridge and safety centre.*
59. MSC.1/Circ:1370: *Guidelines for the design, construction and testing of fixed hydrocarbon gas detection systems.*
60. MSC.1/Circ.1374/Rev.1: *Information on prohibiting the use of asbestos on board the ships.*
61. MSC.1/Circ.1379: *Unified interpretation of SOLAS Regulation II-1/3-5 (materials containing asbestos).*
62. MSC.1/Circ.1384: *Guidelines for the testing and approval of fixed high-expansion foam systems.*
63. MSC.1/Circ.1387/Corr.1: *Revised guidelines for the approval of fixed water-based local application fire-fighting systems for use in category a machinery spaces (MSC/Circ.913)*
64. MSC.1/Circ.1388: *Unified interpretation of Chapter 12 of the International Code for Fire Safety Systems.*
65. MSC.1/Circ.1395/Rev.6: *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.*
66. MSC.1/Circ.1417 and Corr.1: *Guidelines for Passenger Ship Tenders.*
67. MSC.1/Circ.1432: *Revised guidelines for the maintenance and inspection of fire protection systems and appliances.*
68. MSC.1/Circ.1435: *Unified interpretations of the FTP Code.*
69. MSC.1/Circ.1436: *Amendments to the unified interpretations of SOLAS Chapter II-2, the FSS Code, the FTP Code and related fire test procedures (MSC/Circ.1120).*
70. MSC.1/Circ.1456: *Unified interpretations of SOLAS Chapter II-2 and. the FSS and FTP Codes.*
71. MSC.1/Circ.1459: *Unified interpretations of SOLAS Convention, IBC and IGC Codes.*
72. MSC.1/Circ.1471: *Recommendation on safety measures for existing vehicle carriers carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo*.
73. MSC.1/Circ.1472 *Guidelines for the design, performance, testing and approval of mobile water monitors used for the protection of on-deck cargo areas of ships designed and constructed to carry five or more tiers of containers on or above the weather deck.*
74. MSC.1/Circ.1487: *Unified Interpretations of chapters 5, 9 and 10 of the FSS Code.*
75. MSC.1/Circ.1499: *Unified Interpretations of chapter 3 of the FSS Code.*
76. MSC.1/Circ.1501: *Unified interpretations of SOLAS regulation II-2/16.3.3 for products requiring oxygen-dependent inhibitors.*
77. MSC.1/Circ.1505: *Unified interpretations of SOLAS Regulation II-2/13.6.*

78. MSC.1/Circ.1510: *Amendment to the unified interpretations of SOLAS Chapter II-2, the FSS Code, the FTP Code and related fire test procedures (MSC/Circ.1120)*
79. MSC.1/Circ.1511: *Unified interpretation of SOLAS regulations II-2/9 and II-2/13.*
80. MSC.1/Circ.1514: *Performance standard, functional requirements and system requirements for the assessment of smoke management systems.*
81. MSC.1/Circ.1515: *Revised design guidelines and operational recommendations for ventilation systems in ro-ro cargo spaces.*
82. MSC.1/Circ.1516: *Amendments to the revised guidelines for the maintenance and inspection of fire protection systems and appliances (MSC.1/Circ.1432)*
83. MSC.1/Circ.1527: *Unified interpretations of SOLAS Chapter II-2.*
84. MSC.1/Circ.1528: *Unified interpretations of Chapters 5, 6 and 9 of FSS Code.*
85. MSC.1/Circ.1533: *Revised Guidelines on evacuation analysis for new and existing passenger ships.*
86. MSC.1/Circ.1549: *Notification of amendments to paragraph 3.2.5 of IGC Code.*
87. MSC.1/Circ.1552: *Amendments to the Guidelines on alternative design and arrangements for fire safety (MSC/Circ.1002).*
88. MSC.1/Circ.1554: *Unified interpretations of Chapters 9 of FSS Code.*
89. MSC.1/Circ.1555: *Unified interpretations of SOLAS Chapter II-2.*
90. MSC.1/Circ.1556: *Unified interpretations of Chapter 8 of the FSS Code and the revised guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS Regulation II-2/12 (Resolution A.800(19)) as amended by Resolution MSC.265(84).*
91. MSC.1/Circ.1559: *Unified interpretations of IGC Code (as amended by Resolution MSC.370(93))*
92. MSC.1/Circ.1574/Corr.1: *Interim guidelines for use fibre reinforced plastic (FRP) elements within ship structure: Fire Safety Issues.*
93. MSC.1/Circ.1581: *Unified interpretations of SOLAS Chapter II-2.*
94. MSC.1/Circ.1582: *Unified interpretations of Chapters 15 of FSS Code.*
95. MSC.1/Circ.1588/Rev.1: *Revised emergency response procedures for ships carrying dangerous goods (EmS Guide)*
96. MSC.1/Circ.1616: *Unified interpretations of SOLAS Chapter II-2.*
97. MSC.1/Circ.1617: *Unified interpretations of IGC Code.*
98. MSC.1/Circ.1634: *Unified interpretations of SOLAS Chapter II-2.*

IACS Resolutions:

1. UR F2 Rev.2 *Aluminium coatings on board oil tankers and chemical tankers*
2. UR F5 Rev.1 *Pump room alarms*
3. UR F6 Rev.1 *Standardisation of flash points*
4. UR F7 Rev.3, Corr.1 *Portable instruments for measuring oxygen and flammable vapour concentrations*
5. UR F13 Rev.1 *Gland seals in pump room bulkheads*
6. UR F20 Rev.7 *Inert gas systems*
7. UR F24 Rev.2 *Temperature of steam and heating media within the cargo area*
8. UR F27 *Cargo openings in the bottoms of topside tanks of ships carrying alternatively oil and grain*
9. UR F32 *Fire detecting system for unattended machinery spaces*
10. UR F35 Rev.8 *Fire protection of machinery spaces*
11. UR F41 *Sea intakes for fire pump on ships with ICE class*
12. UR F45 *Installation of BWMS on-board ships*
13. UR F46 *Low pressure CO_2 piping system*

14. UI SC16 Rev.2 *Definitions (Reg. II-2/3.34)*
15. UI SC17 Rev.2 *Definitions - Control Stations (SOLAS Reg. II-2/3.18)*
16. UI SC25 Rev.2 *Fixed gas fire-extinguishing systems (FSS Code, Ch. 5, 2.1.3.2)*
17. UI SC30 Rev.3 *Fire-extinguishing arrangements in machinery spaces*
18. UI SC35 Rev.3 *Fixed Fire Detection and Fire Alarm System (FSS Code, Ch. 9, 2.5 System Control Requirements, FSS Code, Ch. 9, 2.5.1 Visual and Audible Fire Signals)*
19. UI SC41 Rev.2 *Means of Escape (Reg. II-2/13.4.1.3)*
20. UI SC42 Rev.3 *Precaution against ignition of explosive petrol and air mixture in closed vehicle spaces, closed ro-ro spaces and special category spaces*
21. UI SC43 Rev.3 *Precaution against ignition of explosive petrol and air mixture in closed vehicle spaces, closed ro-ro spaces and special category spaces*
22. UI SC45 Rev.1 *Fire integrity of bulkheads and decks (Reg. II-2/9.2.3 and 9.2.4)*

23. UI SC46 Rev.1 *Protection of stairways and lift trunks in accommodation spaces, service spaces and control stations (Reg. II-2/9.2.3.4.1)*
24. UI SC48 Rev.1 *Fire protection arrangements in cargo spaces (Reg. II-2/1.6.4 and Reg. II-2/10.7.1.3)*
25. UI SC49 Rev.3 *Fire protection arrangements in cargo spaces (Chapter II-2, Regulation 10.7.2)*
26. UI SC52 Rev.1 *Special requirements for ships carrying dangerous goods (Reg. II-2/19.3.4.2)*
27. UI SC54 Rev.3 *Location and separation of spaces (Reg. II-2/4.5.1)*
28. UI SC55 Rev.2 *Location and separation of spaces (Reg. II-2/4.5.2.2)*
29. UI SC62 Rev.2 *Inert gas systems (FSS Code, Ch. 15, 2.3.2.7 and 2.3.2.8)*
30. UI SC73 Rev.2 *Fire protection of weather decks Reg. II-2/20.4 and 20.6)*
31. UI SC75 Rev.1 *Fire protection arrangements in cargo spaces (Reg. II-2/20.3.1.3)*
32. UI SC76 *Engine bearing temperature monitors (Chapter II-1, Regulation 47.2 [1981])*
33. UI SC79 Rev.5 *Certified Safe Type Electrical Equipment for Ships Carrying Dangerous Goods*
34. UI SC84 Rev.2 *Purpose Built Container Space (Reg. II-2/19.2.2.2)*
35. UI SC85 Rev.2 *Ro-Ro Space (Reg. II-2/19.2.2)*
36. UI SC87 Rev.2 *Certification of Carriage of Solid Dangerous Bulk Cargoes (Reg. II-2/19.3 and 19.4)*
37. UI SC89 Rev.4 *Ventilation of Cargo Spaces*
38. UI SC90 Rev.1 *Bilge Drainage (Reg. II-2/19.3.5)*
39. UI SC91 Rev.1 Corr.1 *Personal Protection - Protective Clothing (SOLAS Reg. II-2/19.3.6.1)*
40. UI SC92 Rev.1 *Personal Protection - Self-Contained Breathing Apparatus (Reg. II-2/19.3.6.2)*
41. UI SC97 Rev.2 *Connection of a pump to fire main (Reg. II-2/10.2.2.3.3)*
42. UI SC98 Rev.1 *Fire hose nozzles of a plastic type material (Reg. II-2/10.2.3.3)*
43. UI SC101 Rev.1 *Main vertical zones (Reg. II-2/9.2.2.1)*
44. UI SC102 Rev.1 *Cold Service (Reg. II-2/5.3.1.1)*
45. UI SC103 Rev.1 *Insulation of machinery space boundaries (Reg. II-2/19.3.8)*
46. UI SC106 Rev.1 *Galley exhaust duct (Reg. II-2/9.7.5.2.1)*
47. UI SC107 Rev.1 *Continuous ceiling (Reg. II-2/9.2.2.2.3)*
48. UI SC108 Rev.1 *Galley exhaust duct (Reg. II-2/9.7.5.1)*
49. UI SC109 Rev.1 *Open Top Container Holds - Water Supplies (Reg. II-2/19.3.1)*
50. UI SC110 Rev.1 *Open Top Container Holds - Ventilation (Reg. II-2/19.3.4)*
51. UI SC111 Rev.1 *Open Top Container Holds - Bilge Pumping (Reg. II-2/19.3.5)*
52. UI SC114 Rev.1 *Emergency Fire Pump Access (Reg. II-2/10.2.2.3.2.1)*
53. UI SC118 Rev.2 *Exhaust duct from galley ranges (Reg. II-2/9.7.5.1.1 and 9.7.5.2.1)*
54. UI SC119 Rev.1 *Balancing ducts (Reg. II-2/9.4.1.2 and Reg. II-2/9.4.2)*
55. UI SC120 Rev.2 Corr.1 *Access to forecastle spaces on tankers SOLAS regulations II-2/4.5.2.1 and 4.5.2.2, IBC Code paragraph 3.2.3 and IGC Code paragraph 3.2.4 Restriction on boundary openings*
56. UI SC121 Rev.2 Corr.1 *Fire Pump Isolation Requirements*
57. UI SC125 Rev.3 *B and C Class Divisions (Reg. II-2/3.4 and Reg. II-2/3.10)*
58. UI SC126 Rev.2 Corr.1 *Fire Protection Materials for Cargo Ships (SOLAS regulations II-2/4.4.4, 5.3, 6.2.1 and 6.3.1)*
59. UI SC127 Rev.2 Corr.1 *Paints, varnishes and other finishes*
60. UI SC129 Rev.2 *Fire Detection in Unmanned Machinery Spaces (Reg. II-2/7.4)*
61. UI SC130 Rev.2 *Fire Detection and Sprinkler Systems in Refrigerated Chambers and Similar Spaces (Reg. II-2/7.5.2 and Reg. II-2/10.6.1.1) (Reg. II-2/41-2.5 as contained in MSC24(60), FSS Code, Ch. 8, 2.1.1)*
62. UI SC132 Rev.4 *Release Operation of the CO2 System FSS Code, Ch 5, 2.1.3.2 (as amended by MSC.339(91))*
63. UI SC133 *Oil Mist Detector on High Speed Engines - "equivalent device" (Chapter II-1, Regulation 47.2)*
64. UI SC146 Rev.2 *Fire hose couplings and nozzles (Reg. II-2/10.2.3)*
65. UI SC147 Rev.2 *Watertight door closure*
66. UI SC148 Rev.2 *Ventilation by fan coil units and internal circulation fans (Reg.II-2/5.2.1.2, II-2/5.2.1.3 and Reg.II-2/7.9.3)*
67. UI SC149 Rev.2 *Gas Measurement and Detection - Portable instruments (SOLAS Reg. II-2/4.5.7.1)*
68. UI SC150 Rev.1 *Location of the foam system equipment (FSS Code, Ch. 14, 2.1.2 and 2.3.1)*
69. UI SC152 *Use of emergency generator in port (Chapter II-1, Regulations 42.1.4 and 43.1.4)*
70. UI SC156 Rev.2 *Doors in watertight bulkheads of cargo ships and passenger ships*
71. UI SC158 Rev.1 *Horizontal fire zone concept (Reg. II-2/20.2.2.1)*
72. UI SC159 Rev.1 Corr.1 *Equivalent Protection (SOLAS II-2/10.7.2)*
73. UI SC160 Rev.1 *Method IIIC Construction (Reg. II-2/7.5.5.3)*
74. UI SC162 Rev.1 *Emergency fire pumps in cargo ships - General (Reg. II-2/10.2.2.3.1.2)*
75. UI SC163 Rev.2 *Emergency fire pumps in cargo ships - sea suction and sea valve (FSS Code, Ch. 12, 2.2.1.1) (SOLAS Chapter II-2, Reg.10, 2.2.3.1) (SOLAS Chapter II-2, Reg.10, 2.2.4.2)*
76. UI SC164 Rev.1 *Emergency fire pumps in cargo ships - priming (FSS Code, Ch. 12, 2.2.1.3)*

77. UI SC166 Rev.1 *Waste receptacles (SOLAS 2000 Amendments (MSC.99(73)), Reg.ll-2/4.4.2)*
78. UI SC167 Rev.1 Corr.1 *Electrical distribution boards*
79. UI SC168 Rev.1 *Hydrants for dangerous goods (SOLAS 2000 Amendments (MSC.99(73))*
80. UI SC169 Rev.1 *Foam systems positions of aft monitors*
81. UI SC172 Rev.1 *Monitoring the concentration of hydrocarbon gases in cargo pump rooms on oil tankers (Chapter II-2, Reg 4.5.10.1.3 (Res MSC.99(73))*
82. UI SC174 Rev.1 A 60 *Front Insulation of Tankers (Reg.II-2/9.2.4.2.5)*
83. UI SC176 Rev.1 *Fixed Local Application Fire Extinguishing System (Reg.II-2/10.5.6)*
84. UI SC178 Rev.1 *Emergency Fire Pumps in Cargo Ships (FSS Code, Ch. 12, 2.2.1.3) FSS Code, Chapter 12, paragraph 2.2.1.3 Suction heads*
85. UI SC188 Rev.3 *Segregation of Cargo Oil Tanks (Reg.II-2/4.5.1.1) SOLAS Reg. II-2/4.5.1.1)*
86. UI SC197 Rev.2 *Non-combustible cargoes (Reg.II-2/10.7.1.4)*
87. UI SC198 Corr.1 *Sections in local application fire extinguishing systems (Reg.II-2/10.5.6.3)*
88. UI SC199 *Fire fighting systems in cargo sampling lockers (Reg.II-2/10.6.3.2)*
89. UI SC200 Corr.1 *Container storage arrangement for equivalent fixed gas fire extinguishing systems*
90. UI SC201 Rev.1 Corr.1 *Location of paint lockers within cargo block*
91. UI SC204 Corr.1 *Storage of fire-extinguishing media forward the cargo holds*
92. UI SC205 *Portable fire-fighting appliances in cargo holds loaded with vehicles with fuel in their tanks (Regulation II-2/20.6.2)*
93. UI SC211 Corr.1 *Protection of fuel oil (Regulations II-2/3.6 and 4.5.1.1)*
94. UI SC214 *Portions of open decks utilized for the storage of gas bottles Regulation II-2/4.3 Arrangements for gaseous fuel for domestic purposes*
95. UI SC217 Corr.2 *Nozzles installation for fixed water based local application fire-fighting systems for use in category A machinery spaces (MSC/Circ 913)*
96. UI SC218 Rev.1 *Fire Testing of Equivalent Water-Based Fire Extinguishing Systems (IMO MSC/Circ.1165, Appendix B, 4.5.1)*
97. UI SC219 Rev.1 *Fire Testing of Equivalent Water-Based Fire Extinguishing Systems (IMO MSC/Circ.1165, Appendix B, 4.5.4.1)*
98. UI SC239 *Insulation with approved non-combustible materials (Reg. II-2/3.2.3)*
99. UI SC241 *Manually operated call points (SOLAS II-2/7.7)*
100. UI SC243 Rev.1 *Access to controls for closing of ventilation of vehicle, special category and ro-ro spaces (SOLAS II-2/20.3.1.4.1)*
101. UI SC245/Rev.1 *Suction and discharge piping of emergency fire pumps, which are run through the machinery space*
102. UI SC247 *Emergency exit hatches to open deck (SOLAS Reg. II-2/13.1)*
103. UI SC250 Corr.2 *Fire - Extinguishing Arrangements in Cargo Spaces (Res. MSC.268(85), IMSBC Code)*
104. UI SC252 *Controls for releasing carbon dioxide and activating the alarm in the protected space (FSS Code 5.2.2.2)*
105. UI SC260 Rev.1 *Sample Extraction Smoke Detection System (FSS Code / Chapter 10 / 2.4.1.2 as amended by MSC.292 (87))*
106. UI SC262 Rev.1 *Fixed Foam Fire Extinguishing Systems, Foam generating Capacity (FSS Code / CHAPTER 6 / 3.2.1.2 and 3.3.1.2 as amended by Res. MSC.327(90))*
107. UI SC268 *Arrangements for fixed hydrocarbon gas detection systems in double-hull and double bottom spaces of oil tankers SOLAS Chapter II-2, Regulation 4.5.7.3.1*
108. UI SC269 Rev.1 *Means of escape from the steering gear space in cargo ships*
109. UI SC270 Rev.1 *Fire pumps in ships designed to carry five or more tiers of containers on or above the weather deck (Res. MSC.365(93), SOLAS II-2/10.2.1.3, II- 2/10.2.2.4.1.2, II-2/10.7.3.2.3, II-2/19.3.1 and IMO FSS Code Ch. 12.2.2.1.1)*
110. UI SC271 *Additional indicating unit in the cargo control room in accordance with amended FSS Code Chapter 9.2.5.1.3*
111. UI SC272 Rev.1 *Inert gas supply to double-hull spaces (SOLAS II-2/4.5.5.1)*
112. UI SC273 Rev.1 *Inclusion of mediums of the fire-fighting systems in lightweight (SOLAS II-1/2.21, SOLAS II-2/3.28) and lightship condition (IS Code 2008 Paragraph 2.23)*
113. UI SC275 Rev.1 *Suitable number of spare air cylinders to be provided in connection with drills*
114. UI SC276 *Escape from machinery spaces on passenger ships SOLAS Chapter II-2, Regulation 13.4.1*
115. UI SC277 *Escape from machinery spaces on cargo ships SOLAS Chapter II-2, Regulation 13.4.2*
116. UI SC278 *Escape from accommodation spaces, service spaces and control stations on cargo ships SOLAS Chapter II-2, Regulation 13.3.3.2 and 13.3.3.3*
117. UI SC284 *Automatic shutdown of the inert gas system and its components parts*
118. UI SC285 *Operational status of valves to cargo tanks*
119. UI SC286 *Operational status of the inert gas system*
120. UI SC287 *Low pressure audible alarm system*

121. UI SC288 *Carriage of Dangerous Goods – Required Air Changes*
122. UI SC291 *Safe Type requirements for two-way portable radiotelephone apparatus for fire-fighter's communication*
123. UI SC294 *Fire integrity of the division between engine room and urea or sodium hydroxide solution tank installation spaces*

124. UI CC5 *Fire protection and fire extinction IBC Code Chapter 11*

125. UI FTP3/Rev.3 *Fire door (FTP Code sub-section 5.3 and Annex 1, Part 3 -Test for "A", "B" and "F" class divisions)*
126. UI FTP4/Rev.2 *Fire resistant windows on tankers*
127. UI FTP5/Corr.1 *Testing and approval of "A" class divisions – fastening of insulation material and details of joints*
128. UI FTP6/Rev.1 *Testing and approval of pipe penetrations and cable transits for use in "A" class divisions (IMO FTP Code 2010 Annex 1 Part 3)*

129. REC.99 Rev.1 *Recommendations for the Safety of Cargo Vessels of less than Convention Size*
130. REC.123 *Recommendation based on IMO instruments - MSC.1/Circ.1370 "Guidelines for the design, construction and testing of fixed hydrocarbon gas detection systems" and Resolution MSC.292 (87) "Amendments to the FSS Code Chapter 16 Fixed Hydrocarbon Gas Detection Systems"*
131. REC.131 *Uniform application of SOLAS Ch.II-2 Reg. 4.5.7.3.2.1 for accepting a constant operative inerting systems (COIS) as an alternative to fixed hydrocarbon gas detection equipment in double hull and double-bottom spaces on oil tankers*
132. REC.135 *Rooms for emergency fire pumps in cargo ships*
133. REC.152 *Survival crafts launching stations. Guidance for applying the requirements of 11.3.1 of the IGC Code (on ships constructed on or after 1 July 2016)*

EU legal documents:

1. *MED Directive– European Parliament and Council Directive on Marine Equipment,* 2014/90/EU, 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 Convention, flying the flag of EU Member State. Under this directive, Commission Implementing Regulation (EU) 2022/1157, as amended, apply.

List of amendments effective from 1 January 2024

Item	*Title/Subject*	*Source*
Page 2	Reference to Publication 12/P has been added	IP Code
1.3.1	List of technical documentations has been expanded	PRS own
1.4.3.18 3.4.2 11.1.20.5 11.3.1.4.1	Revision of MSC Circ. has been implemented and indicated	MSC.1/Circ.1430/Rev.3
2.1.3.1.5	Revision of MSC Circ. has been indicated	MSC.1/Circ.1374/Rev.1
6.2.7.2 11.6.4.6	Revision of MSC Circ. has been indicated	MSC.1/Circ.1276/Rev.1
4.1.3.11 11.1.10.5	FSS Code amendments	MSC.484(103)
6.5.1.1 6.5.1.2 6.5.2	Revision of MSC Circ. has been indicated	MSC.1/Circ.1395/Rev.6
11.6.6.2.3.2.1 11.6.6.2.3.2.6 11.6.6.2.4.2	FSS Code amendments	MSC.457(101)
11.13	Requirements for industrial personnel transfer vessel – reference to Publication 12/P have been added	IP Code

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