Volume 6

OMCS CLASS

Overseas Marine Certification Services

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OMCS CLASS
Overseas Marine Certification Services

AUTOMATION

VOLUME VI

CHAPTER 1 GENERAL PROVISIONS

1.1 GENERAL REQUIREMENTS

1.1.1 General requirements

1.1.1.1 This PART applies to classed ships intended to be affixed a class notation of automation to the class character and provided with automatic control and/or remote control systems (hereinafter called automated system) for machinery and electrical installations. And it is the supplement to other relevant PARTS and Chapters of the Rules.

1.1.1.2 The automated system consists of control, safety and alarm systems (including displays).

1.1.1.3 The additional class notations of automation are specified as follows:

a. AUT - 0 - indicating that the ship's propulsion plant can be remotely controlled from the bridge control station with the machinery spaces (including engine room centralized control station or room) periodically unattended.
b. MCC - indicating that the machinery and electrical installations are capable of being operated with continuous supervision by watch - keepers from a centralized control station or mm in the engine room.
c. BRC - indicating that the ship's propulsion plant can be remotely controlled from the bridge control station with the engine room attended by watch - keepers.

1.1.1.4 Classed ships with the additional class notations of automation as mentioned in 1.1.1.3 are to be adaptable to all sailing conditions, including maneuvering.

1.1.1.5 The safety of classed ships with the additional class notations of automation as mentioned in 1.1.1.3 are to be same to that of ships with the machinery spaces attended. Means are to be provided to ensure that the machinery and electrical equipment can be manually operated from a local position in case of failure of the automated systems.

1.1.2 Definitions

1.1.2.1 For the purpose of this PART:

a. Automatic control means self - regulating control carrying out ordered instruction to operate the machinery without action by an operator.
b. Remote control means control of a device by an operator from a distance through mechanical, electrical, electronic, pneumatic, hydraulic, electromagnetic (radio) or optical means or combination thereof.

c. Local control means direct manual control by an operator of machinery through a device located on or adjacent to the controlled machinery.

d. Control station (room) means spaces fitted with monitoring means capable of controlling the machinery and electrical installations. They are mainly divided into four categories as follows in this PART:

- Centralized control station (room) (abbreviated to CCS) of engine room means control station (room) concentrately fitted with all monitoring means for automated equipment in engine room;
- Bridge control station (abbreviated to BCS) means control station monitoring the propelling plant and other equipment in bridge;
- Local control station (abbreviated to LCS) means control station where machinery and electrical installations are locally controlled ;

e. Other control stations mean control stations except the above - mentioned three ones.

f. Safety systems means systems which will operate automatically for safeguarding the machinery or electrical equipment in question in the following three modes of operation in case of serious faults endangering the main propulsion engines, boilers, electric generating plants and other essential machinery or electrical equipment:

Mode a: immediate shutdown, e.g. , emergency stop of main engines, emergency cutoff of boiler fuel oil and emergency cutoff of electric power supply to consumers. And such machinery or equipment is not to be put into operation again if without the manual resetting;

Mode b: The operation of the machinery is temporarily adjusted to the prevailing conditions, e. g., by reducing the output or speed revolution of the machinery;

Mode c: The normal operating conditions are restored by starting of standby machinery.

g. Alarm means a visual and audible signal of a predetermined out - of - limits parameter for the monitored machinery or system.

h. Group alarm means a common alarm activated by any abnormal conditions of the monitored machinery or system.

i. Fail - safe principle means that upon failure or malfunction of a component or system, the output automatically reverts to a predetermined design state of least critical consequence.

j. Override means the special control measures for the skipping of a certain procedure or a certain safeguard action soas to effect compulsory operation to the machinery or electrical equipment for a short period to ensure the safety of the ship.

k. Emergency shutdown device means device independent of automated system and intended for manual activation in an emergency to stop the operation of machinery and electrical installations, e. g. emergency stop button of main engines, emergency cutoff button of boiler fuel oil and emergency cutoff button of electric power supply to consumers.

l. Local area network means a general - purpose computer communication network, serving a small geographical location, where exchange and transmission of data take place, and is common use for the devices interconnected with the network.

1.1.3 Plans and documents to be submitted for approval

1.1.3.1 Where a ship is intended to be assigned an additional notation of automation, the following plans and documents associated with control, alarm (display) and safety systems covered by this PART are to be submitted to the Society for approval:

a. List of monitored and display points;
b. List of alarm points (including display position and mode of alarms in the control station/ room) ;
c. Items of safety systems;
d. Schematic diagrams of (electric, pneumatic, hydraulic) power supply to automated systems.

1.1.3.2 The following plans and documents are to be submitted to the Society for information:

a. Specifications of automated systems, including :
   - Schematic diagrams and function instructions of automatic and remote control systems;
   - Details of monitoring functions in control station (room) (including the control exchange between control stations/rooms) ;
   - Specifications of test method and self- monitoring function for alarm systems;
b. Overall specifications of computer system (if fitted) , including at least the following:
   - Detailed specifications of monitoring functions;
   - Description of self - monitoring and operation;
   - Description of uninterruptable power supply (abbreviated to UPS) (if fitted) ;
c. Description of sharing information in local area network (if any);
d. List of the relevant equipment associated to automatic/remote control

1.1.3.3 Other plans and documents are to be submitted if deemed necessary by the Society.

1.1.3.4 Manufacturers producing automated installations are to additionally submit plans and documents relating to the survey of the products for approval, in accordance with relevant provisions of the Society.

1.1.4 Trials

1.1.4.1 The automated systems together with the associated machinery and electrical equipment are to be subject to mooring and sea trails in accordance with the test program approved by the Society so as to ascertain the adequacy of installation and the satisfaction of working conditions.

1.1.4.2 The alarm points of automated system and the set values of safety system parameter which are determined in compliance with the requirements of the Rules as shown by the trials are to be recorded and maintained onboard for examination.

CHAPTER 2: FIRE EXTICTION, FIRE DETECTION AND INERT GAS SYSTEMS

2.1 WATER FIRE MAIN SYSTEM

2.1.1 Capacity of fire pumps

2.1.1.1 Where fire pumps am used for the operation of a deck foam system in tankers (refer to II - 2/61 of SOLAS Convention), the capacity of fire pumps is to be sufficient to satisfy the requirements of deck foam system operation at its required output and the simultaneous use of two jets with 12 m of water at the required pressure from the tire main.

2.1.2 Number and arrangement of fire pumps

2.1.2.1 Cargo ships are to be provided with fire pumps according to the following:

a. In ships of 500 gross tonnage and upwards but less than 1 000 gross tonnage, at least two power pumps are to be provided, one of which is to be an independent pump.
b. In ships of less than 500 gross tonnages, at least one power pump is to be available as a main fire pump (hand pump may be provided in case of navigating only in port).

2.1.2.2 The total suction head of the pump is not to exceed 4.5 m under all conditions of list and trim likely to be encountered in service and the suction piping is to be designed to minimize suction losses.

2.1.3 Diameter and pressure of fire main

2.1.3.1 The diameter of the fire main and water service pipes is to be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously, except that in the case of cargo ships the diameter need only be sufficient for the discharge of 140 m3/h.
In general, the diameter of the fire main is to be not less than that required in the following formula:

$$d = L/1.2 + 25 \quad \text{mm}$$

but need not exceed 125 mm for cargo ships and 180 mm for passenger ships and in no case to be less than 50 mm, where :
d = internal diameter of the fire main, in mm;
L = length of ship measured between perpendiculars, in m.

2.1.3.2 In passenger ships of less than 1,000 gross tonnage, with the two pumps simultaneously delivering through the nozzles specified in 2.1.3.1 of this Section and sufficient hydrants to provide for the required

quantity of water through any adjacent hydrants, a minimum pressure of 0. 25N/mm^2 are to be maintained at ail hydrants.

2.2 FIXED GAS FIRE - EXTINGUISHING SYSTEM

2.2.1 General Requirements

2.2.1.1 Means are to be provided for automatically giving audible warning of the release of fire – extinguishing medium into any space in which personnel normally work or to which they have access. The alarm is to operate for not less than 20 s before the medium is released. For the alarm used for the release of fire - extinguishing medium into cargo pump rooms onboard oil tankers carrying crude oil or petroleum products having a flash point not exceeding 60°C (closed cup test), if air operated, the air supply is to be clean and dry; if electrically operated, the arrangements are to be such that the electrical operating mechanism is located outside the pump room, in accordance with the requirements of these regulations.

2.2.1.2 At each location of the means of control of any fixed gas fire-extinguishing system there is to be sufficient illumination including emergency lights in addition to the main lights.

2.2.1.3 Stations used for all fixed gas fire-extinguishing systems are to comply with the following requirements:

a. Stations are to be used only for the storage of containers and other components and parts of the systems.
b. Stations are to be provided with direct communications to the bridge or control station.
c. The key to the container storage rooms or control stations is to be stowed in a box with glass cover which is to be situated in an easily accessible and conspicuous position near the door.
d. In each station there is to be displayed a clear and permanent schematic diagram showing the arrangement of the containers, manifold, piping and fittings relating to the release of extinguishing medium, together with the concise instructions for the operation of the system.

2.2.2 High-pressure carbon dioxide systems

2.2.2.1 For cargo spaces the quantity of carbon dioxide available is, unless otherwise provided to be sufficient to give a minimum volume of free gas equal to 30% of the gross volume of the largest cargo space so protected in the ship.

2.2.2.2 For machinery spaces the quantity of carbon dioxide carried is to be sufficient to give a minimum volume of free gas equal to the larger of the following volumes, either:

a. 40% of the gross volume of the largest machinery space so protected, the volume to exclude that part of the casing above the level at which the horizontal area of the casing is 40% per cent or less of the horizontal area of the space concerned taken midway between the tank top and the lowest part of the casing; or

b. 35% of the gross volume of the largest machinery space protected, including the casing.

Provided that the above-mentioned percentages may be reduced to 35% and 30% respectively for cargo ships of less than 2000 gross tonnage; provided also that if two or more machinery spaces are not entirely separate they are to be considered as forming one space.

2.2.2.3 Where the volume of free air contained in air receivers in any space is such that, if released in such space in the event of fire, such release of air within that space would seriously affect the efficiency of the fixed fire-extinguishing system, the Society may require the provision of an additional quantity of fire-extinguishing medium. In general, for the space (e.g. engine room) fitted with starting air receivers, the effect upon free air volume in the air receivers is to be taken into account, when calculating CO_2. Or, if compressed air in the air receivers can be discharged into open space located outside the engine room through safe valves and its conducting pipes, the effect upon air receivers is not to be taken into account, when calculating CO_2.

2.2.2.4 When carbon dioxide is used as an extinguishing medium for cargo pump room in tankers having a flash point not exceeding 60 °C, the quantity of carbon dioxide is to be sufficient to give a minimum volume of free gas equal to 45% of the gross volume of the cargo pump room including the casing. For tankers having a flash point exceeding 60 °C, if the cargo pump room is located in a separate space, it is to be treated as a machinery space.

2.2.2.5 For cargo spaces, other than special category spaces, intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion, if a carbon dioxide system is fitted, the quantity of gas available is to be at least sufficient to give a minimum volume of free gas equal to 45% of the gross volume of the largest such cargo space which is capable of being sealed.

2.2.2.6 If a carbon dioxide system is fitted for closed ro/ro cargo spaces, the quantity of gas available is to be at least sufficient to give a minimum volume of free gas equal to 45% of the gross volume of the largest such cargo space.

2.2.2.7 Piping of carbon dioxide is to comply with the following requirements:

a. Each connecting pipe led from each bottle head valve to the collecting pipe is to be provided with a non-return valve.
b. The manifold connecting the collecting pipes and control valves is to be provided with a pressure gauge having a range of 0 to 24.5 MPa.
c. The CO_2 piping is not to be led through the accommodation spaces and it is also to avoid passing through the service spaces. If it is impracticable to avoid CO_2 piping passing through service spaces, CO_2 piping within the service spaces is not to be fitted with detachable joints.
d. For machinery spaces of Category A or cargo pump rooms, the piping is to be provided with sufficient number and adequate size of nozzles so that 85% of carbon dioxide can be discharged into the space within 2 min. Approximately 10% of the total quantity of CO_2 is to be discharged to the protected space below the floor in engine room.

e. The diameter of carbon dioxide piping leading to the above - mentioned spaces as stated in (d) is to be determined in accordance with the proposed quantity conveyed by the piping. The maximum quantity of carbon dioxide conveyed by the corresponding pipe diameters is given in Table 2.2.2.7(5).

Table 2.2.2.7 (5)
Internal diameter of pipes and conveyed quantity

Maximum quantity of carbon dioxide conveyed by the pipe (Kg)	Internal diameter of pipes, (mm)	Maximum quantity of carbon dioxide conveyed by the pipe (Kg)	Internal diameter of pipes, (mm)
60	15	2400	80
100	20	3300	90
135	25	4750	100
275	32	6800	114
500	40	9500	127
1100	50	15250	152
1600	65		

f. The minimum wall thickness of C& pipes is given in Table 2.2.2.7 (6). Slight difference from the thickness listed in the Table will be accepted for the purpose of selecting stand and pipes.

Table 2.2.2.7 (6)
Minimum wall thickness of CO_2 pipes

External diameter of pipes, (mm)	Wall thickness, (mm)	
	Piping forward of control valves	Piping after control valves
21.3 ~ 26.9	3.2	2.6
30.0 ~ 48.3	4.0	3.2
51.0 ~ 60.3	4.5	3.6
63.5 ~ 76.1	5.0	3.6
82.5 ~ 88.9	5.6	4.0
101.6	6.3	4.0
108.0 ~ 114.3	7.1	4.5
127.0	8.0	4.5
133.0 ~ 139.7	8.0	5.0
152.4 ~ 168.3	8.8	5.6

g. Distribution piping leading to cargo spaces is not to be less than 20 mm bore, and those leading to the nozzles are not to be less than 15 mm bore.

h. CO_2 piping is to be provided with compressed air cleaning connections at its manifold.

i. CO_2 pipes are to be of seamless steel pipes.
j. For special category spaces and closed ro-ro cargo spaces, the piping arrangements are to be such that 2/3 of the gas required for a particular space can be discharged into the space within 10 min.

2.2.2.8 Carbon dioxide bottles are to comply with the following requirements:

a. CO_2 bottles are to be of seamless steel bottles. Each bottle is to be furnished with a certificate and to have on its body permanent identifications of weight, capacity, hydraulic test pressure, date of tests, serial number of the factory and also inspection stamp.
b. The bottles are to be wholly painted in bright colour but white in way of the markings, and with letter s of "carbon dioxide (or CO_2)".
c. The charging ratio for CO_2 bottles is to be suitable for the strength of the bottles and generally not to be more than 0.67 kg/L.
d. Bottle head valves are to be associated with steel or copper seamless tubes having a diameter of 10 to 12 mm snipped off at their lower end and terminated near the bottom of the bottles.
e. Bottle head valves are to be provided with safety diaphragms or other approved safety devices. The bursting pressure of the safety diaphragms is to be 18.6 1 MPa. After bursting of safety diaphragms, the escape gas is to be led to the open atmosphere through suitable piping. However, where the storage room for CO2 cylinders is fitted with a dedicated mechanical ventilation system capable of providing at least 6 air changes per hour and keeping temperature in the room below 45 °C, such piping may be dispensed with.
f. Bottles head valves are to be made of forged bronze or other suitable materials.
g. CO_2 bottles are to be divided into groups according to the required quantity for different spaces to be protected. If releasing of the carbon dioxide is hand-operated, the number of bottles in each group is not to exceed 12.

2.2.2.9 Testing of carbon dioxide systems

a. CO_2 bottles and bottle head valves are to be subjected to a hydraulic test of 24.5 MPa. Safety diaphragms are to be burst-tested in accordance with 2.2.2.8(e) by selecting 10% at random.
b. On completion of fitting the bottle head valves, CO_2 bottles are to be subjected to an air-tightness test in the workshop to a pressure equal to the design pressure of the bottle.
c. The pipes and valves of CO_2 piping systems are to be subjected to a hydraulic test with a pressure of 11.8 MPa for control valves and pipes between bottle head valves and control valves, and 1MPa for pipes between control valves and nozzles. The above tests may be carried out in workshops. On completion of installation on board, CO_2 piping is to be subjected to an air-tightness test of at least 0.69 MPa with the ends closed.
d. On completion of installation on board, the CO_2 piping system is to be function-tested with a pneumatic pressure not less than 2.47 MPa for checking the operation of releasing mechanism.

2.2.3 Low-pressure carbon dioxide systems

2.2.3.1 The rated amount of carbon dioxide, time of discharge into the protected space, location of nozzles in the protected spaces and signals warning that the system is activated are to comply with the relevant requirements for CO_2 high-pressure systems.

2.2.3.2 Vessel(s), refrigerating plants, control devices and other equipment of the system are to be located in a space complying with requirements applying to CO_2 high-pressure systems.

2.2.3.3 Vessel(s) and relevant devices are to comply with the following requirements:

a. The rated amount of liquid carbon dioxide are to be stored in vessel(s) under the working pressure in the range of 1.8 to 2.2 MPa. The normal liquid charge in the container is to be limited to provide sufficient vapour space to allow for expansion of the liquid under the maximum storage temperatures than can be obtained corresponding to the setting of the pressure relief valves but is not to exceed 95% of the volumetric capacity of the container.
b. The vessel(s) are to be designed, constructed and tested in accordance with the requirements of these regulations for pressure vessels. For this purpose the design pressure is to be taken not less than the relief valve setting. Besides, provision is to be made for:
    - Pressure gauge;
    - High pressure alarm: to be warning at 2.2 MPa ;
    - Low pressure alarm: to be warning at 1.8 MPa;
    - Safety diaphragms ;
    - Branch pipes with stop valves for filling the vessel;
    - Discharge pipes;
    - Liquid CO_2, level indicator, fitted on the vessel(s) , and remote level indicator located in the place where the remote control of the CO_2 release, if any, is fitted;
    - Two safety relief valves arranged so that either valve can be shut off while the other is connected to the vessel. The setting of the relief valves is to be not less than 2.2 MPa. The capacity of each valve is to be such that the vapours generated under fire condition can be discharged with a pressure rise not more than 20% above the setting pressure. The discharge horn the safety valves is to be led to the open.
c. The vessel (s) and outgoing pipes permanently filled with carbon dioxide are to have thermal insulation preventing the operation of the safety valve in 24 h after de - energizing the plant, at ambient temperature of 459: and an initial pressure equal to the starting pressure of the refrigeration unit. The insulating materials and their liners are to be to the satisfaction of the Society, having in mind, in particular, their fire resistance and mechanical properties, as well as protection against penetration of water vapours.

2.2.3.4 Refrigerating plant is to meet the following requirements:

a. The vessel(s) am to be serviced by two automated completely independent refrigerating units solely intended for this purpose, each comprising a compressor and the relevant prime mover, evaporator and condenser.

b. The refrigerating plant is to comply with the relevant requirements of PART FIVE. The refrigerating capacity and the automatic control of each unit are to be so as to maintain the required temperature under conditions of continuous operation during 24 h at the sea temperature up to 32°C and ambient air temperature up to 45T.
c. In the event of failure of either one of the refrigerating units the other is to be actuated automatically. Provision is to be made for local manual control of the refrigerating plant.
d. Each electric refrigerating unit is to be supplied from the main switchboard bus - bars by a separate feeder.
e. Cooling water supply to the refrigerating plant (where required) is to 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 is to be taken from not less than two sea connections, preferably one port and one starboard.

2.2.3.5 Pipes and fittings are to meet the following requirements:

a. The pipes, valves and fittings are to be in accordance with the requirements of Volume Three for a design pressure not less than the design pressure of the CO_2 vessels.
b. Safety relief devices are to be provided in each section of pipe that may be isolated by block valves and in which there could be a build - up of pressure in excess of the design pressure of any of the components.
c. The piping system is to be designed in such a way that the Cop flows through in liquid phase up to the discharge nozzles. To this end the pressure at the nozzles is to be not less than 1.0 MPa.

2.2.3.6 The fire control station and the engineers quarters are to be equipped with audible and visual alarms activated when a fault arises.

2.2.3.7 Means of release control of low - pressure carbon dioxide systems are to meet the following requirements:

a. The release of CO_2 is to be initiated manually.
b. If a device is provided which automatically regulates the discharge of the rated quantity of carbon dioxide into the protected spaces, it is to be also possible to regulate the discharge manually.
c. If the system serves more than one space, means for control of discharge quantities of CO, are to be provided, e.g. Automatic timer or accurate level indicators located at the control position(s) .

2.2.3.8 Testing of low - pressure carbon dioxide systems

a. The pipes, valves and fittings and assembled system are to be tested complying with the requirements of 2.5 in TOMO III of the rules.
b. The pipes from the vessel(s) to the release valves on the distribution manifold are to be subject to a pressure test to not less than 1.5 times the set pressure of the safety relief valves. The test may be carried out in workshops.

c. The pipes from the release valves on the distribution manifold to the nozzles am to be tested for tightness with a pressure of 1.0 MPa and free flow of CO_2, after having been assembled on board.
d. The refrigerating plant, after having been fitted on board, is to be checked for its proper operation.
e. On completion on board, the CO_2 system is to be function tested for checking the operation of release mechanism.

2.3 FIRE DETECTION SYSTEM FOR PERIODICALLY UNATTENDED MACHINER Y SPACES

2.3.1 General requirements

2.3.1.1 An automatic fire detection system is to be fitted in the machinery spaces.

2.3.1.2 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.

2.3.1.3 The fire detection indicating panel is to be located on the navigation bridge, fire control station, or other accessible place where a fire in the machinery space will not render it inoperative.

2.3.1.4 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 are to be audible throughout the navigation bridge and the accommodation area of the personnel responsible for the operation of the machinery space.

2.3.1.5 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 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.

2.3.1.6 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.

2.3.1.7 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.

2.3.1.8 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 preset time.

2.3.1.7 When fire detectors are provided the means to adjust their sensitivity, necessary arrangements are to be ensured to fix and identify the set point.

2.3.1.8 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 preset time.

2.3.1.9 The fire detection indicating panel is to be provided with facilities for functional testing.

2.3.1.10 The fire detection system is to be fed automatically from the emergency source of power by a separate feeder if the main source of power fails.

2.3.1.11 Facilities are to be provided in the fire detection system to release manually the fire alarm horn the passageways having entrances to engine and boiler rooms, navigation bridge and control station in engine room.

2.3.1.12 The testing of the fire detection system on board is to be carried out to the satisfaction of the Society.

2.4 INERT GAS SYSTEMS

2.4.1 General requirements

2.4.1.1 All types of inert gas systems are to comply with the following:

a. An automatic control capable of producing suitable inert gas under all service conditions is to be fitted.
b. Materials used in inert gas systems are to be suitable for their intended purpose in accordance with the provisions of the Society.
c. All the equipment is to be installed on board and tested under working conditions to the satisfaction of the Surveyor.
d. Subsequent surveys are to be carried out at the intervals as required by the Society.

2.4.2 Inert gas systems on tankers carrying crude oil and petroleum products

2.4.2.1 The following requirements apply where an inert gas system based on boiler flue gas and oil fired inert gas generators is fitted on board tankers intended for the carriage of crude oil and petroleum products in bulk 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.

2.4.2.2 In addition to the requirements of II - 2/62 of the SOLAS Convention, the following is to be complied with:

a. When two blowers am provided, the total required capacity of the inert gas system is preferably to be divided equally between the two blowers, and in no case is one blower to have a capacity less than 1/3 of the total capacity required.
b. In particular those parts of scrubbers, blowers, non - return devices, scrubber effluent and other drain pipes which may be subjected to corrosive action of the gases and/or liquids are to be either constructed of corrosion resistant material or lined with rubber, glass fibre epoxy resin or other equivalent coating material.
c. The compartment in which any oil fired inert gas generator is situated is to be treated as machinery space of Category A with respect to fire protection.
d. Arrangements are to be made to vent the inert gas from oil fixed inert gas generators to the atmosphere when the inert gas produced is off specification, e.g , during start - up or in the event of equipment failure.
e. Automatic shut-down of the oil fuel supply to inert gas generators is to be arranged on predetermined limits being reached with respect to low water pressure or low water flow rate to the cooling and scrubbing arrangement and with respect to high gas temperature.
f. Automatic shut-down of the gas regulating valve is to be arranged with respect to failure of the power supply to the oil fired inert gas generators.

2.4.3 Nitrogen generator systems

2.4.3.1 The following requirements are specific only to the gas generator system and apply where inert gas is produced by separating air into its component gases by passing compressed air through a bundle of hollow fibres, semi-permeable membranes or adsorbed materials.

2.4.3.2 Where such systems are provided in place of the boiler flue gas or oil fired inert gas generators referred to in 2.4.2, the following requirements of Reg.II-2/62 or equivalent requirements of Resolution A.567(14) remain applicable for the piping arrangements, alarms and instrumentation downstream of the gas generator: 9.1, 9.2, 11, 12, 13, 14, 16.1.1, 16.2, 16.3, 17, 18, 19.1.6, 19.1.8, 19.1.9, 19.3, 19.4, 19.6, 19.8, 21.

2.4.3.3 A nitrogen generator consists of a feed air treatment system and any number of membrane or adsorbed modules in parallel necessary to meet the required capacity which is to be at least 125% of the maximum discharge capacity of the ship expressed as a volume.

2.4.3.4 The air compressor and the nitrogen generator may be installed in the engine room or in a separate compartment. A separate compartment is to be treated as one of "other machinery spaces" with respect to fire protection.

2.4.3.5 Where a separate compartment is provided, it is to be positioned outside the cargo area and is to be fitted with an independent mechanical extraction ventilation system providing 6 air changes per hour. A low oxygen alarm is to be fitted as well. The compartment is to have no direct access to accommodation spaces, service spaces and control stations.

2.4.3.6 The nitrogen generator is to be capable of delivering high purity nitrogen with CO_2 content not exceeding 5% by volume. The system is to be fitted with automatic means to discharge "off-spec" gas to the atmosphere during start-up and abnormal operation.

2.4.3.7 The system is to be provided with two air compressors. 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. Only one air compressor may be accepted provided that sufficient spares for the air compressor and its prime mover are carried on board to enable their failure to be rectified by the ship's crew.

2.4.3.8 A feed air treatment system is to be fitted to remove free water, particles and traces of oil from the compressed air, and to preserve the specification temperature.

2.4.3.9 Where fitted, a nitrogen receiver/buffer tank may be installed in a dedicated compartment or in the separate compartment containing the air compressor and the generator or may be located in the cargo area. Where the nitrogen receiver/buffer tank is installed in an enclosed space, the access is to be arranged only from the open deck and the access door is to open outwards. Permanent ventilation and alarm are to be fitted as required in 2.4.3.5.

2.4.3.10 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.

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

2.4.3.12 At least two non - return devices are to be fitted in the inert gas supply main, one of which is to be of the double block and bleed arrangement. The second non - return device is to be equipped with positive means of closure.

2.4.3.13 Instrumentation is to be provided for continuously indicating the temperature and pressure of air:

a. At the discharge side of the compressor;
b. At the entrance side of the nitrogen generator.

2.4.3.14 Instrumentation is to be fitted for continuously indicating and permanently recording the oxygen content of the inert gas downstream of the nitrogen generator when inert gas is being supplied.

2.4.3.15 The instrumentation referred to in 2.4.3.14 is to be placed in the cargo control room and in the machinery control room (or in the machinery space).

2.4.3.16 Audible and visual alarms are to be provided to indicate:

a. Low feed - air pressure from compressor as referred to in 2.4.3.13 (a);
b. High air temperature as referred to in 2.4.3.13(a);
c. High condensate level at automatic drain of water separator as referred to in 2.4.3.8; failure of electrical heater, if fitted;
d. Failure of electrical heater, if fitted;
e. Oxygen content in excess of that required in 2.4.3.6;
f. Failure of power supply to the instrumentation as referred to in 2.4.3.14 of this Section.

2.4.3.17 Automatic shut - down of the system is to be arranged upon alarm conditions as required in 2.4.3.16(a) to (e).

2.4.3.18 The alarms required 2.4.3.16(a) - (f) are to be fitted in the machinery space and cargo control room, where provided, but in each case in such a position that they are immediately received by responsible members of the crew.

2.4.4 Nitrogen/inert gas systems fitted for purposes other than inerting required in SOLAS Reg. II-2/60

2.4.4.1 The section 2.4.4 applies to systems fitted on oil tankers of less than 20,000 DWT.

2.4.4.2 The requirements of 2.4 apply except 2.4.3.1, 2.4.3.2, 2.4.3.3 and 2.4.3.7.

2.4.4.3 Where the connections to the cargo tanks, to the hold spaces or to cargo piping are not permanent, the non - return devices required in 2.4.3.12 may be substituted by two non - return valves.

CHAPTER 3: ADDITIONAL REQUIREMENTS FOR FIRE-FIGHTING SHIPS

3.1 GENERAL REQUIREMENTS

3.1.1 General requirements

3.1.1.1 The firefighting ships intended to extinguish the following fires respectively are divided into Grades 1, 2 and 3 in this Chapter:

Fire-fighting Ships of Grade 1 are for early stage fire-fighting;
Fire-fighting Ships of Grade 2 are for large tire-fighting;
Fire-fighting Ships of Grade 3 are for large or oil fire-fighting.

3.1.1.2 In addition to complying with the requirements of this Chapter, the fire-fighting ships are to comply with the applicable requirements in other PARTS and Chapters of the Rules and the requirements of the Society's Rules for Materials and Welding.

3.1.1.3 The minimum requirements for fire-fighting ships of Grades 1, 2 and 3 am listed in Table 3.1.1.3.

3.1.1.4 Where it is necessary for fire-fighting ships to deviate from the requirements of this Chapter due to their specific missions such as geographical limitations or particular objects to be served, the Society may impose other requirements as appropriate on such ships. And individual provisions in this Chapter may also be relaxed subject to agreement of the Society.

Table 3.1.1.3
List of Minimum Requirements for Fire-Fighting Ships

Equipment	Fight-fighting ships			
	1	**2**		**3**
Minimum number of water monitors	2	3	4	4
Minimum discharge rate per monitor, m3/h	1200	2400	1800	2400
Minimum number of fire pumps	1	2		2
Minimum total pumps capacity, m^3/h	2400	7200		9600
Characteristics of water monitors:				
Minimum height of jet trajectory of monitors above sea level, m	45	70		70
Minimum lenght of monitor jets, m	120	150		150
Minimum fuel capacity for simultaneous working of all water monitors, h	24	96		96
Fixed foam extinguishing system:				
Minimum number of foam monitors	-	-		2
Minimum discharge rate per system, m^3/h	-	-		300
Time of continuous foam production, min	-	-		30
Mobile fire-fighting equipment:				
Portable foam generator				
Minimum foam capacity, m^3/h	-	100		100
Time of continuous foam production, min	-	30		30
Fire hoses				
Number of hoses connections each side of ship	4	8		8
Number of fireman´s outfit	4	8		8

3.1.2 Plans and documents to be submitted

3.1.2.1 In addition to those required in the relevant Chapters of the Rules, the following plans and documents in triplicate am to be submitted to the Society for approval:

a. Arrangement and specification of water monitor system (including capacity, range and jet trajectory of pumps and monitors);
b. Plan of seating arrangement for water monitors;
c. Arrangement of water spray systems (if provided);
d. Arrangement and specification of fireman's out it and air compressors;
e. Arrangement and specification of searchlights;
f. Plan of remote control system of monitors;
g. Plan of positions of hose connection and arrangement of associated piping on each side of ship;
h. Stability calculations for fire-fighting operations;
i. Operation manual, including:
    - Detailed description of each fire-fighting system and the equipment;
    - Instruction on use, test and maintenance of fire-fighting installations and equipment;
    - Instruction on operation of ship during fire-fighting.

3.1.2.2 In addition to the plans and documents required in the relevant Chapters of the Rules, the following documents are to be submitted to the Society for information:

a. Particulars of the means of keeping the ship in position during fire-fighting operations;
b. Estimation of fuel consumption during fire-fighting operations.

3.1.2.3 For fire-fighting ships of Grade 2 or Grade 3, in addition to the plans and documents required in 3.1.2.1 and 3.1.2.2, the following plans and documents in triplicate am to be submitted to the Society for approval :

a. For fire-fighting ships of Grade 2:
    - Arrangement and specification of the mobile fire-fighting equipment;
b. For fire-fighting ships of Grade 3 :
    - Arrangement and specification of the mobile fire-fighting equipment;
    - Plans of seating arrangement for foam monitors;
    - Arrangement and specification of foam systems;
    - System for remote control of the foam monitors.

3.1.2.4 Other plans and documents are to be submitted to the Society for approval or for information when deemed necessary by the Society.

3.1.3 Surveys and tests

3.1.3.1 Upon completion of the installation of the systems and equipment required in this Chapter, tests are to be made under working conditions to verify that the performance of the systems and equipment, the angle of list as well as the maneuverability of ships are satisfactory.

3.1.4 Notations

3.1.4.1 For all grades of fire-fighting ships complying with the requirements in this Chapter, the following notations are to be granted respectively:

Fire-fighting ships of Grade 1:	Fire-Fighting Ship 1
Fire-fighting ships of Grade 2:	Fire-Fighting Ship 2
Fire-fighting ships of Grade 3:	Fire-Fighting Ship 3

3.1.4.2 For ships provided with a water spraying system complying with 3.3.1 for delivering the efficient cooling water spraying over all the exposed vertical surfaces of the hull so as to enable the ship to approach the burning object for fire-fighting and/or rescue purposes, the notation of Water Spraying is to be affixed to that mentioned in 3.1.4.1.

3.2 BASIC REQUIREMENTS

3.2.1 Hull structure

3.2.1.1 The hull structure is to be strengthened if necessary to withstand the forces imposed by the fire-fighting systems when operating at their maximum capacity.

3.2.2 Stability

3.2.2.1 When all monitors are in operation at full capacity in the most adverse direction for the stability, the ship is to have satisfactory stability corresponding to the load conditions.

3.2.3 Manoeuvrability

3.2.3.1 The ships are to be of sufficient size and to have side thrusters and propulsion machine7 of sufficient power for adequate maneuverability during fire-fighting operations.

3.2.3.2 Side thrusters and main propellers are to keep the ship at a standstill in calm waters at all combinations of capacity and direction of throw of the water monitors and foam monitors, and the most unfavorable combination is not to be more than 80% of the available propulsion force in any direction.

3.2.3.3 In order to prevent overloading during combined maneuverings, means am to be provided for sending visual and sound alarms to the navigating bridge at 80% of the available propulsion power, and for automatically reducing the power at 100% of the available propulsion force, so as to prevent sudden or complete loss of power due to power overload.

3.2.3.4 A simple control system is to be provided for operating the main propulsion plant and side thrusters to adjust:

a. The resultant thrust vector for the ship;
b. The turning moment of the ship;
c. The ship's heading.

3.2.4 Lighting

3.2.4.1 Two searchlights are to be provided to permit operations of the fire-fighting equipment at night.

3.2.4.2 The searchlights are to be capable of providing at a range of 250 m in clear atmospheric conditions a level of illumination of 50 lx within an area of not less than 11 m diameter. They are to be capable of being adjusted in the horizontal and vertical directions.

3.2.5 Fuel capacity and replenishment

3.2.5.1 The quantity of fuel oil for continuous fire-fighting operations at maximum required capacity comply with Table 3.1.1.3 of this Chapter.

3.2.5.2 The fuel capacity is to be additional to what is provided for normal operation of the ship, propulsion.

3.2.5.3 Consideration is to be given the requirements that any fuel which may be required while the ship is operating on station can be safely received on board.

3.2.6 Operation manual

3.2.6.1 An approved operation manual is to be kept on board.

3.3 PROTECTION AND FIRE-FIGHTING EQUIPMENT

3.3.1 Water spray systems

3.3.1.1 Where a fire-fighting ship is provided with a fixed water spray system ,the system is to ensure a protection of all outside vertical areas of hull above waterline, including superstructures, deckhouses, seating's for water monitors and other fire-fighting equipment.

3.3.1.2 For areas internally insulated to class A - 60, the water spray system is to supply water at least 5 L/min* m^2; for other areas to be at least 10 L/min* m^2**.**

3.3.1.3 The pumping capacity is to be sufficient to supply simultaneously at the required pressure the sections which serve the maximum area exposed to radiant heat from a fire. Where the main fire pumps are used for this purpose, they are to be capable of operating this system, the water monitors and the hose stations simultaneously at the required pressure. A connection with a shut-off valve is to be fitted between the piping system for the water monitors and the supply line for the water spray system.

3.3.1.4 The water spray system is to be divided into sections so that it will be possible to close down sections covering surfaces which are not exposed to radiant heat.

3.3.1.5 The nozzles of the water spray system are to be arranged to give an even distribution of water spray over the protected areas.

3.3.1.6 Deck scuppers and freeing ports are to be of sufficient area to ensure efficient drainage of water from decks and horizontal surfaces in all conditions when the water spray system is in operation.

3.3.1.7 Means are to be taken to ensure that necessary visibility from the wheelhouse and the remote-control station can be maintained during the water spray operations.

3.3.2 Water monitor systems

3.3.2.1 The minimum number of water monitors and their characteristics are to comply with Table 3.1.1.3 of this Chapter.

3.3.2.2 Arrangements are to be such that:

a. The water monitors are to be capable of being adequately adjusted in the vertical and horizontal direction to achieve the best target point of the jet, and to be so positioned that the jets will be unimpeded within the required range of operation;
b. The water monitors are to be fitted on fixed and robust seatings so as to withstand the imposed forces from all modes of operation;
c. At least two water monitors are to be equipped with a permanently fitted nozzle which can give solid or a spray jet as required.

3.3.2.3 Control of water monitors In addition to the local manual operation, the monitors are to be capable of being activated and maneuvered by remote control from a protected position ensuring a good view of the monitors and of the area to be served.

3.3.2.4 Design and seating's of water monitors

a. The water monitors are to be of robust construction and are to be of a type approved by the Society.
b. The seating's of the monitors are to be of adequate strength for all modes of operation.

3.3.2.5 Pumping and piping system

The pumping and piping systems are to comply with the relevant requirements of 3.3.4.

3.3.3 Fixed foam monitors system

3.3.3.1 For Fire-fighting ships of grade 3, in addition to a water monitor system, a fixed low-expansion foam monitor system complying with 3.3 .3 .2 to 3 .3 .3 .6 is to be provided.

3.3.3.2 Performance and capacity

a. Two foam monitors are to be provided on board, with each capacity not less than 300 m3/h and a foam expansion ratio not more than 12:1.
b. The arrangement and position of the monitors and foam system are to be such that a height of throw at least 50 m above the sea level can be obtained, when both monitors are used simultaneously with maximum capacity.
c. Sufficient foam concentrate is to be available for at least 30 min. of simultaneous operation of both monitors at maximum capacity. When determining the required capacity of the foam concentrate, the concentration ratio is to be assumed 5%.

3.3.3.3 Arrangement

a. The foam generating systems are to be of a fixed type, with individual foam concentrate tank, foam-mixing unit and piping to the monitors.
b. The system may be supplied by the pumps of water monitors, in such cases, the pump pressure is to be adjustable to ensure producing the maximum capacity of foam.

3.3.3.4 Control of foam monitors

a. In addition to the local manual control, foam monitors are to be provided with remote control which is to include the operation of the valves necessary for the control of both water and foam. The remote control of foam monitors is to be located at the same remote-control station for the water monitors.

3.3.3.5 Design and seating's of foam monitors

a. The foam monitors are to be of robust construction.
b. The seating's of the monitors are to be of adequate strength for all modes of operation.

3.3.3.6 Pumping and piping systems

The pumping and piping systems are to comply with the relevant requirements of 3.3.4.

3.3.4 Pumping and piping systems for water and foam

3.3.4.1 General requirements

a. The pumps and piping systems serving the monitors are not to be used for other services except for the water spray system referred to in 3.3.1 and for the own tire extinguishing system of the ship.
b. Where the pumps are used for the fixed water spray systems, the piping is to be independent from that serving the monitors.
c. The piping system horn the pumps to the water monitors is to be separate from the piping system to the hose connections required for the mobile fire-fighting equipment as specified in 3.3.5.
d. The piping systems are to have arrangements to avoid overheating of the pumps at low delivery rates.
e. Suction lines arc to be as short and straight as practicable. The design maximum water velocity in the suction lines is normally not to exceed 2 m/s.
f. Piping between pumps and water monitors is to have a design maximum water velocity normally not exceeding 4 m/s.
g. All piping from seawater inlets to water monitors is to be internally protected against corrosion. Piping exposed to be weather is to be protected also externally.

3.3.4.2 Arrangement of pumps

The pumps for fire-fighting systems and their prime movers are to be adequately protected, and so located that they will be easily accessible during operation and maintenance.

3.3.4.3 Seawater suctions

a. Seawater suctions for the fire-fighting pumps are not to be arranged for other purposes.
b. The seawater suction valve, pressure valve and the pump motor are to be operable from the same position. Valves with nominal diameter exceeding 450 mm are to be power actuated as well as manually operable.
c. Starting of fire-fighting pumps when water inlet valves are closed is to be prevented either by an interlock system or by an audible and visual alarm.
d. Seawater inlets and sea chests are to be of a design ensuring an even and sufficient supply of water to the pumps. The location of the seawater inlets and sea chests is to be such that the water supply is not impeded by the ship's motions or by the water flow to and from bow thrusters, side thrusters, azimuth thrusters or main propellers.
e. Seawater suctions of the fire-fighting pumps are to be arranged as low as practicable to avoid icing.
f. Efficient means arc to be provided for clearing the strainers of seawater suctions.

3.3.5 Mobile fire-fighting equipment

3.3.5.1 For Fire-fighting ships of grade 2 or 3, the mobile fire-fighting equipment complying with 3.3.5.2 is to be provided.

3.3.5.2 High-expansion foam generator

a. Where required in Table 3.1.1.3, the mobile high-expansion foam generator is to be provided with a capacity not less than 100 m^3/min. for fighting of external fires.

b. Foam-forming liquid is to be stored in portable containers of about 20 L individual capacity. The total capacity of foam-forming liquid is to be sufficient for 30 min. of continuous foam production.

3.3.6 Fire Hoses

3.3.6.1 Hose stations are to be provided on each side of the ship in accordance with Table 3.1.1.3.

3.3.6.2 Each hose station is to be provided with a hydrant, a hose and a nozzle capable of producing a jet or a spray and simultaneously a jet and a spray.

3.3.6.3 The hoses are to be 15 m in length and not less than 38 mm nor more than 65 mm in diameter.

3.3.7 Fireman's outfit

3.3.7.1 Fire-fighting ships are to be provided with fireman's outfit in accordance with Table 3.1.1.3.

3.3.7.2 Each self-contained breathing apparatus is to have a capacity of at least 1200 L of free air, and at least one spare air bottle is to be provided for each apparatus.

3.3.7.3 The fireman's outfit is to be stored in a safe position readily accessible from the open deck.

3.3.7.4 A suitable air compressor is to be provided for recharging the air bottles. It is to be capable of recharging the bottles of the required apparatus within 30 min

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