C H A P T E R I I - 2 N (1)

Construction, fire protection, fire detection and fire extinction Additions to the provisions of the "Fire Safety Systems Code" (FSS-Code) chapter 5, paragraphs 2.1 and 2.2

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Part A High-pressure CO_2 fire-extinguishing systems

1 General

The provisions of paragraphs 2.1 and 2.2 of Chapter 5 of the FFS-Code shall apply by analogy.

2 CO_2 storage spaces

.1 The space where CO_2 containers are stored shall be separately ventilated, shall have direct access from open deck and may not be used for other purposes.

.2 The space shall be insulated, ventilated and arranged in such a way that the temperature shall not normally exceed 40°C.

.3 Drainage shall be led separately over board or to the open deck.

.4 All doors and hatches shall be easily operable from both sides.

.5 Communication shall be possible by means of ordinary telephones, portable radiotelephones or the like between the navigation bridge or the fire control room and the release stations of the system.

.6 The CO_2 containers shall be fixed in an upright position and arranged in such a way that the container valves are easily accessible for control. Furthermore, the containers shall be isolated from the deck to prevent outside bottom corrosion.

3 CO_2 containers

.1 The CO_2 containers shall comply with the latest Danish regulations for CO_2 containers. CO_2 containers complying with foreign standards may be used provided that they comply with the rules of a recognised classification society.

.2 Every container or container valve shall be provided with a frangible disc guaranteed by the manufacturer to protect the container against harmful overpressure, and the arrangement shall permit free passage of gas from the container if the frangible disc breaks.

.3 Tare and gross weights, month and year of the latest pressure test as well as the test pressure shall be stamped on the container.

.4 *The companies that charge the containers are responsible for the content, which may not exceed 0.67 kg per litre of the container volume. The companies shall issue a certificate stating the content of each container.*

.5 *If a weight loss of 10 per cent or more of the charged weight stamped on the container is observed, the container in question shall be recharged, however the extinguishing capacity required shall always be available.*

.6 *The containers shall be pressure-tested every 20 years by a recognised test institute, classification society or the chief engineer of the ship in question. A discharged container may not be recharged until a new pressure test has been carried out with a satisfactory result if 5 or more years have passed since the latest pressure test.*

4 ***CO_2 piping, etc.***

.1 *All pipes outside machinery and boiler spaces shall be externally and internally galvanised, and the fittings used shall be corrosion-resistant.*

.2 *Only flexible high-pressure hoses are permitted between container valves and the manifold of the CO_2 containers.*

.3 *The internal diameter of the above connections shall be at least 10 mm.*

.4 *Non-return valves shall be fitted on the manifold for each container connection in such a way that a container may, if necessary, be disconnected from the manifold without putting the system out of operation.*

.5 *Immediately after the main stop valve, a connection facility for testing the free flow of air through the whole distributing system shall be fitted.*

.6 *The CO_2 piping including the manifold shall be made of certificated seamless steel pipes. Only flanges for pressure level 10 N/mm^2 may be used. Manifolds shall be fitted with a safety pressure release valve with an outlet pipe leading to the open air. The valve shall open at 13 N/mm^2 and have a size so as to prevent dangerous overpressure in the manifold. The external diameters and wall thickness shall be in accordance with table 1. Differentiation in wall thickness may be permitted for pipes manufactured in accordance with other standards.*

Table 1 Manifolds, including pipes to main stop valve

Nominal diameter in mm	*Wall thickness in mm*
20	*3.2*
25	*4.0*
32	*4.0*
40	*4.0*
50	*4.5*
65	*5.0*
80	*5.6*
125	*7.1*
150	*8.0*
	8.8

.7 Distributing valves for cargo spaces shall be of the quick-opening type in order to prevent freezing and the cargo space or spaces to which they are connected shall be clearly indicated by marking.

.8 All the fittings used between container valves and main stop valves and distributing valve manifold shall be made of steel. Threaded fittings may be used only up to 2" pipe thread.

.9 Main stop valves shall be made of steel or of an equivalent approved material and be designed for a working pressure of 10 N/mm^2.

.10 Wall thickness deviations may be accepted for pipes manufactured according to other standards.

.11 All fittings used between main stop valve and between distributing valve manifold and outlet nozzles may be made of annealed castings or tough-hard iron, and the joints shall be made without free threads. Pipes from main stop valve or distributing valve manifold to outlet nozzles shall at least have a wall thickness as stated in table 2. Pipes from CO_2 containers to valves shall at least have an external diameter and a wall thickness as given in table 1.

Table 2 Pipes from main stop valve/distributing valve manifold to outlet nozzles

Nominal diameter in mm	*Wall thickness in mm*
20	*2.6*
25	*3.2*
32	*3.2*
40	*3.2*
50	*3.6*
65	*3.6*
80	*4.0*
125	*4.5*
150	*5.0*
	5.6

.11 *CO_2 pipes for "total flooding" systems for machinery spaces shall be designed in accordance with the amount of CO_2 that they are meant to carry. The maximum amount of CO_2 may not exceed the values stated in table 3.*

Table 3 Maximum amount of CO_2

CO_2 quantity	***Internal pipe diameter***
45 kg	*13 mm*
100 kg	*19 mm*
135 kg	*25 mm*
275 kg	*32 mm*
450 kg	*38 mm*
1100 kg	*50 mm*
2000 kg	*76 mm*
3250 kg	*89 mm*
4750 kg	*101 mm*
6800 kg	*114 mm*
9500 kg	*127 mm*
15250 kg	*152 mm*

5 Pressure testing of pipes

.1 *The entire pipe system shall be hydraulically pressure-tested. The test pressure between container valves and the blank flange arrangement fitted and between container valves and manifold for cargo spaces shall be at least 19 N/mm^2. The hydraulic test pressure of the remaining pipe system shall be at least 2.5 N/mm^2. Pipes in the control system shall be pressure-tested by air to 1.3 times the working pressure.*

.2 *The hydraulic pressure-test of manifolds referred to in .1 may be carried out before installed on board if a pressure test certificate from the manufacturer can be presented.*

.3 *When the pressure tests referred to in .1 and .2 have been carried out, a leakage test of the entire pipe system shall be carried out after the final installation of the system has taken place. The test shall be carried out with air at a pressure of 1 N/mm^2.*

6 Release arrangement

.1 *The two control handles required shall be arranged in such a way that the handle for the opening of the main stop valve must be operated before the handle for the opening of the container valves.*

.2 *If the quantity of CO_2 in the system exceeds 225 kg, a hydraulic or pneumatic (servo) control arrangement is required for the opening of the container valves and the main stop valve. Wire control arrangement is not permitted in such systems.*

.3 *Servo-operated release stations shall be located outside the CO_2 space. There shall be free access from the open deck to the release station.*

.4 *The servo-operated arrangement shall be designed so that the control system may be ventilated at the release station and that any fault in the manoeuvre sequence does not prevent the release of the system.*

.5 *It shall be possible to open and close the main stop valve locally by hand at the maximum CO_2 pressure in the manifold. The valve shall be provided with indicators for open and closed position, and it shall be so placed that it is easily accessible.*

.6 *Where a separate pressure container serves the servo arrangement, an intermediate stop valve shall be fitted in the pipeline which shall be operated from the release station.*

.7 *If CO_2 gas is used for the operation of the servo arrangement, CO_2 gas from the system must not be vented to an enclosed space unless the concentration of CO_2 gas will become less than 3 per cent in volume of the space in question.*

.8 *Operating devices and all components associated with the servo arrangements, including any power sources and pipelines, shall, in terms of fire technology, be independent of the space or spaces protected by the installation.*

7 Alarm equipment for "total flooding" installations

.1 *In CO_2 protected spaces, an acoustic alarm shall automatically sound before the first release handle is operated. Such an alarm shall, at the maximum noise level in the protected space, be audible everywhere in the space and shall be clearly distinguishable from other acoustic alarms in the ship. The alarm devices shall be clearly marked "CO_2 ALARM".*

.2 *Adequate measures shall be taken to secure the reliability of the alarm system. Such measures include the marking and locking in the open position of valves for propelling gas and the marking of electric connections including fuses. It shall not be possible to put the alarm out of operation because of a fire in the protected space. Electric alarm equipment shall be supplied from the emergency source of power. Alarm signal devices propelled by the released CO_2 gas shall not be used in working spaces.*

.3 *Manifolds for "total flooding" systems shall be provided with a pressure gauge and a pressure transmitter. The pressure transmitter shall automatically sound an acoustic alarm on the main engine alarm system or other suitable alarm systems when any pressure occurs in the manifold.*

8 Testing of the system

.1 *Testing of the system after final installation on board shall be carried out as follows:*

.1 *Leakage test and pressure test if the latter has not been carried out previously.*

.2 Control of the free air flow in all pipes and nozzles.

.3 Control of the alarm equipment.

.4 Functioning test of the system by releasing the whole system with the blank flange referred to in paragraph 9.1 inserted ("total flooding test".) (It is recommended that the installation is pre-tested by means of a single container connected to the manifold before the actual "flooding test" is carried out).

9 Special provisions

.1 It shall be possible to secure the system against inadvertent release during dry docking and similar occasions by the insertion of a blank flange (sliding flange) just after the main stop valve.

.2 Local CO_2 systems installed for the purpose of extinguishing internal fires in engines, e.g. scavenging air fires in diesel engines, are permitted if installed at a suitable place in the engine room and provided the CO_2 concentration does not exceed 3 per cent of the volume of the space in question.

.3 All doors to spaces protected by a CO_2 system shall have a clear sign stating that the space is protected by a CO_2 fire-extinguishing system and that the space shall be left immediately if the alarm sounds.

10 Periodical inspection and maintenance

.1 Suppliers of CO_2 systems shall provide manuals and drawings of the systems, including a checklist for maintenance, in Danish and English.

.2 The quantity of CO_2 shall be checked at least once a year by the chief engineer of the ship or by a classification society or company recognised by the Danish Maritime Authority.

.3 The on-going inspections, etc. performed by the chief engineer or on the initiative of the ship's management shall be recorded in the survey book of the ship, stating the extent of the inspection, any repairs made as well as the date of the inspection.

Part B: Low pressure CO_2 fire-extinguishing systems

1 Construction

.1 With the exception of the provisions for CO_2 containers, the provisions on high-pressure CO_2 fire-extinguishing systems shall apply by analogy, however, design criteria for pipes and nozzles shall be submitted to the Danish Maritime Authority in each individual case.

.2 Tanks for the storage of CO_2 (CO_2 tanks) shall, in terms of design, materials, material dimensions and test pressure, comply with regulations corresponding to those used by a recognised classification society or by a recognised competent authority. The tanks shall be marked in order that they may be identified and shall be marked with test

pressure and date as well as working pressure, volume and supervisor's mark.

2 Pressure-testing and inspection

.1 *CO_2 tanks shall be pressure-tested before installed on board, and subsequently the tanks together with fittings shall be inspected externally every 5 years. The Danish Maritime Authority, a recognised classification society or the chief engineer shall carry out the pressure test as well as external inspections. At the external inspections every 5 years, it shall be possible to remove insulation material of the tank at the points at which this is considered necessary. Pipes and valves at transitional points between insulated and uninsulated areas (cold-conductors) as well as tank supports, flange sockets and valves shall be covered by the external inspection every 5 years.*

.2 *In addition, the chief engineer of the ship shall continuously inspect the installation in accordance with the manual delivered by the manufacturer, including the checklist for maintenance. At least once a year, a thorough external inspection of the tank supports, flange sockets and valves mentioned in .1 shall be carried out.*

.3 *The extent of the external inspections referred to in .1 and .2 as well as any repairs and improvements made shall be recorded in the survey book of the ship stating date and place.*

3 Safety valves

.1 *At least two safety valves shall be fitted directly on each tank. It is permitted to fit a three-way valve for the safety valves arranged in such a manner that it is only possible to shut off one safety valve at a time and that a free flow of air is permitted at all times.*

.2 *The opening pressure of the safety valves may not exceed the permitted working pressure in the tank, and the flow area of each valve shall be sufficient for the tanks not to be exposed to overpressure even if both the refrigeration units mentioned in .1 should fail.*

.3 *Outlet pipes from safety valves shall lead to open deck, and the outlet shall be placed so that CO_2 cannot flow into the interior of the ship. The flow area of the pipe shall be at least twice the total flow area of the valves.*

4 Gauging equipment and shut-off devices

.1 *At least one pressure gauge, including shut-off valve, shall be fitted on each tank.*

.2 *On each tank, an external pipe shall be fitted for the determination of the CO_2 fluid level. An automatic level alarm with a set point of 95 per cent CO_2 content shall also be fitted.*

.3 *Means for checking the quantity of CO_2 shall be so designed that damage does not cause leakage.*

.4 *It shall be possible to shut off all pipelines leading from a tank, with the exception of the safety valves, by means of shut-off valves fitted directly on the tank.*

.5 *It shall be possible to lock the main stop valve of the CO_2 tank in the closed position.*

5 Refrigerating plant and alarm arrangement

.1 *CO_2 tanks shall have at least two refrigerating units that are completely independent of each other with a sufficient and equal capacity and with a malfunction alarm.*

.2 *An automatic alarm for CO_2 leakage in the tank space shall be provided. The alarm shall be connected to the engine alarm panel, and it shall come into operation before the concentration of CO_2 gas in the room has reached 3 per cent.*