Translation. Only the Danish version has legal validity

Order no. 642 of 13 June 2014
issued by the Danish Maritime Authority

Order on fixed CO_2 fire-extinguishing systems[1]

In pursuance of section 1(2), section 3(1)(i), (vi) and (viii) and section 32(8) of the act on safety at sea (*love om sikkerhed til søs*), cf. consolidated act no. 72 of 17 January 2014, and in pursuance of section 1(2), section 3(1)(i), (vi) and (viii) and section 32(8) of the act on safety at sea, as enacted for Greenland by decree no. 71 of 29 January 2013, and in consultation with the Government of Greenland, the following provisions are laid down:

Part 1
Application

Section 1. This order shall apply to:

1) Passenger ships engaged on domestic voyages covered by Notice D from the Danish Maritime Authority, technical regulation on the construction and equipment, etc. of passenger ships engaged on domestic voyages.
2) Fishing vessels with a length L of or above 15 metres as well as fishing vessels with scantlings of or above 100 covered by Notice E from the Danish Maritime Authority, technical regulation on the construction and equipment, etc. of fishing vessels.
3) Commercial vessels with a length L below 15 metres and with scantlings of or above 20, but below 100, covered by Notice F from the Danish Maritime Authority, technical regulation on the construction and equipment, etc. of small commercial vessels.
4) Ships covered by the technical regulation on traditional ships (ships worthy of preservation, sport fishing vessels, etc.).

Subsection 2. This order shall not apply to passenger ships engaged on international voyages, irrespective of size, and to cargo ships with a length of or above 15 metres or with scantlings of or above 100, irrespective of whether they are engaged on domestic or international voyages, as well as recreational craft with a hull length above 24 metres. CO_2 fire-extinguishing systems in these ships are regulated by the order on Notice B from the Danish Maritime Authority, the construction and equipment, etc. of ships. The provisions of part 4 of this order on simple CO_2 systems shall be used for fire-extinction on board ships with a length L below 24 metres and in small spaces on board all ships.

Subsection 3. The provisions of parts 2 and 3 of this order consist of chapter 5 of the "Fire Safety Systems Code" (FSS Code) as well as national Danish requirements for fixed fire-extinguishing systems.

Part 2
General requirements

Section 2. Where the CO_2 quantity is to protect more than one space, the quantity available need not exceed the largest quantity required for any one space so protected. The system shall be fitted with normally

[1] This order has been notified in draft in accordance with Directive 98/34/EC of the European Parliament and of the Council (information procedure directive), as amended most recently by directive 98/48/EC.

closed control valves arranged to direct the extinguishant into the relevant space. Adjacent spaces with independent ventilation systems and not separated by at least class A-0 standard sub-divisions, cf. the order on Notice B from the Danish Maritime Authority, the construction and equipment, etc. of ships, regulation II-2/3, item 2, shall be considered one space.

Subsection 2. The volume of 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-extinguishant. Alternatively, a discharge pipe from the safety valves may be fitted and led directly to the open air.

Subsection 3. Means shall be provided for the crew to safely check the CO_2 quantity in the containers. It shall not be necessary to move the containers completely from the place where they are fixed for this purpose. As regards systems using CO_2 as a fire-extinguishant, suspension bars for a weighing device shall be fitted above each container row or any other device for this purpose shall be available.

Subsection 4. Containers for the storage of fire-extinguishants, piping and associated pressure components shall be designed to pressure codes of practice to the satisfaction of the Danish Maritime Authority having regard to their locations and maximum ambient temperatures expected in service.[2]

Subsection 5. It shall be possible for the ship's crew to check the condition of the CO_2 system in a safe manner. It shall not be possible to inadvertently release the systems in connection with control, maintenance, etc. Maintenance and inspection shall be carried out in accordance with the Guidelines for the maintenance and inspection of fixed carbon dioxide fire-extinguishing systems issued by United Nations' International Maritime Organization (IMO).[3]

Installation requirements

Section 3. The piping for the supply of CO_2 shall be arranged and discharge nozzles so positioned that a uniform distribution of the extinguishant is obtained. System flow calculations shall be performed using a calculation technique acceptable to the Danish Maritime Authority.

Subsection 2. Except as otherwise permitted by the Danish Maritime Authority, pressure containers for the storage of CO_2 shall be located outside the protected spaces in accordance with the order on Notice B from the Danish Maritime Authority, the construction and equipment, etc. of ships, regulation II-2/10.4.3.

Subsection 3. Spare parts for the system shall be stored on board and be to the satisfaction of the Danish Maritime Authority.

Subsection 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.

Subsection 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.

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2 ISO – 9809-1: Refillable seamless steel gas cylinders (design, construction and testing); ISO – 3500: Seamless Steel CO_2 cylinders for fixed fire-fighting installations on ships; 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 – 9329-1: Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 1: Unalloyed steels with specified room temperature properties; ISO – 9329-2: Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 2: Unalloyed and alloyed steels with specified elevated temperature properties; ISO – 9330-1: Welded steel tubes for pressure purposes – Technical delivery conditions – Part 1: Unalloyed steel tubes with specified room temperature properties; ISO – 9330-2: 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.

Subsection 6. A fitting shall be installed in the discharge piping to permit the air testing as required by section 7.

Subsection 7. It shall be possible to protect CO_2 systems against being inadvertently released in connection with yard work in the machinery space.

System control requirements

Section 4. The necessary pipes for conveying fire-extinguishant 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 extinguishant into the space. Where a cargo space fitted with a CO_2 fire-extinguishing system is used as a passenger space, the CO_2 connection shall be blanked during such use. The pipes may pass through accommodations provided 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 spaces 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.

Subsection 2. Means shall be provided for automatically giving audible and visual warning of the release of fire-extinguishant into any ro-ro spaces, container cargo spaces with integrated reefer containers, spaces accessible only through doors or hatches, and other spaces in which personnel normally work or to which they have access. The audible alarms shall be located so as to be audible throughout the protected space with all machinery operating, and it shall be possible to distinguish the alarms from other audible alarms by adjustment of sound pressure or sound patterns. The pre-discharge alarm shall be automatically activated (for example, 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 for less than 20 seconds before the extinguishant is released. Conventional cargo spaces and small spaces (such as compressor rooms, paint lockers, etc.) with only a local release need not be provided with such an alarm.

Subsection 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.

Subsection 4. Automatic release of CO_2 fire-extinguishant shall not be permitted.

Subsection 5. Insofar as possible, CO_2 systems shall be secured against mal-operation.

CO_2 quantity

Section 5. For cargo spaces, the quantity of CO_2 available shall, unless otherwise provided, be sufficient to give a minimum volume of free CO_2 equal to 30% of the gross volume of the largest cargo spaces to be protected in the ship.

Subsection 2. For vehicle spaces and ro-ro spaces that are not special cargo spaces, the quantity of CO_2 available shall at least be sufficient to give a minimum volume of free gas equal to 45% of the gross volume

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[3] IMO circular MSC/Circ.1381, "Guidelines for the maintenance and inspection of fixed carbon dioxide fire-extinguishing systems" or the guidance on the inspection of CO_2 systems issued by the Danish Maritime Authority.

of the largest of the spaces capable of being closed tight. It shall be ensured that at least two-thirds of the gas required for the relevant space is released within ten minutes. Systems using CO_2 as extinguishant shall not be used to protect special cargo spaces.

Subsection 3. For machinery spaces, the quantity of CO_2 available shall be sufficient to give a minimum volume of free CO_2 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.

Subsection 4. The percentages specified in subsection 3 above may, however, be reduced to 35% and 30%, respectively, for cargo ships with a gross tonnage below 2,000 where two or more machinery spaces, which are not entirely separate, are considered as forming one space.

Subsection 5. The volume of free CO_2 shall be calculated at 0.56 m^3/kg.

Subsection 6. For machinery spaces, the fixed piping system shall be such that 85% of the gas can be discharged into the space within 2 minutes.

Subsection 7. For container and general cargo spaces primarily designed to carry various cargoes that are secured or packaged separately, the fixed piping system shall be such that at least two-thirds of the gas can be released into the cargo space within ten minutes. For bulk carriers, the fixed piping system shall be such that at least two-thirds of the gas can be released into the space within 20 minutes. The control system of the installation shall be such that it is possible to release a third, two-thirds or the entire volume of the gas, depending on the loading condition of the cargo space.

Controls

Section 6. CO_2 fire-extinguishing systems for the protection of ro-ro spaces, container cargo spaces with integrated reefer containers, spaces accessible through doors or hatches and other spaces where the personnel usually work or to which they have access shall meet the following requirements:

1) Two separate controls shall be provided for releasing CO_2 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.
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.

Section 7. When the system has been installed, pressure-tested and inspected, the following shall be carried out:

1) A test of the free air flow in all pipes and nozzles; and
2) a functional test of the alarm equipment.

Subsection 2. In case of new-buildings or flagging in, it shall be demonstrated that the CO_2 system will function as intended in all conditions should a fire arise.

Part 3

Low-pressure CO_2 systems

Section 8. Where a low pressure CO_2 system is fitted in accordance with these regulations, the following applies.

1) The system control devices and the refrigerating plants shall be located within the same room where the pressure vessels are stored.
2) The rated amount of liquid CO_2 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 that can be obtained corresponding to the setting of the pressure relief valves, but shall not exceed 95% of the volumetric capacity of the container.

Subsection 2. Provision shall be made for:

1) Pressure gauge.
2) High pressure alarm that is not more than the setting of the relief valve.
3) Low pressure alarm that is 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.

Subsection 3. 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.

Subsection 4. The vessel(s) and outgoing pipes permanently filled with CO_2 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.

Subsection 5. 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.

Subsection 6. 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.

Subsection 7. Each electric refrigerating unit shall be supplied from the main switchboard busbars by a separate feeder.

Subsection 8. 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.

Subsection 9. 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.

Subsection 10. Audible and visual alarms shall be given in a central control station or, in accordance with the order on Notice B from the Danish Maritime Authority, the construction and equipment, etc. of ships, chapter II-1, regulation 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 subsection 1(ii);
2) any one of the refrigerating units fails to operate; or
3) the lowest permissible level of the liquid in the vessels is reached.

Subsection 11. 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).

Subsection 12. If a device is provided which automatically regulates the discharge of the rated quantity of CO_2 into the protected spaces, it shall be also possible to regulate the discharge manually.

Part 4
Simple CO_2 systems
Definitions, etc.

Section 9. Simple CO_2 systems shall mean CO_2 systems for extinguishing fires on board ships with a length L below 24 metres as well as for extinguishing fires in small spaces on board all ships.

Section 10. The system shall consist of a maximum of 2 CO_2 containers of 45 kg.

Subsection 2. The CO_2 quantity shall be calculated as 40% free CO_2 of the gross volume.

CO_2 spaces

Section 11. The space in which the CO_2 containers are stored shall have direct access from open deck and shall not be used for other purposes.

Subsection 2. The space shall be insulated, ventilated and arranged such that the temperature will normally not exceed 40 degrees C.

Subsection 3. Outlets shall be led separately over board or to open deck.

CO_2 containers

Section 12. CO_2 containers shall meet the Danish requirements in force at any time for containers of the nature concerned. CO_2 containers of foreign origin may be permitted if they meet the rules of a recognised classification society on such containers.

Subsection 2. Any container or container valve shall be fitted with a frangible disc which, according to the manufacturer's guarantees, protects the container against harmful overpressure, and the arrangement shall allow gas to flow freely from the container if the frangible disc bursts.

Subsection 3. The tare and gross weight, month and year of the latest pressure test as well as the test pressure shall be stamped on the containers.

Subsection 4. The filling companies are responsible for charging the containers and the degree of filling shall not exceed 0.67 kg per litre container volume. The filling companies shall issue a certificate of the degree of filling of the containers.

Subsection 5. The containers shall be solidly fixed in an upright position and placed so that it is easy to check the container valves. Furthermore, they shall be stored above the floor and be protected against corrosion.

Subsection 6. CO_2 containers shall be pressure-tested every ten years by a recognised test institute or by a recognised classification society. If more than five years have passed since the last pressure test, a discharged container shall not be recharged until a renewed pressure test has been carried out with satisfactory result.

Subsection 7. CO_2 containers shall be weighed or measured for control purposes every year and, if a weight deduction of or above 10% is found compared to the weight stamped on it, the relevant container shall be recharged.

CO_2 piping, etc.

Section 13. All pipes outside machinery and boiler spaces shall be externally and internally galvanised, and the fittings used shall be corrosion-resistant.

Subsection 2. Only flexible high-pressure hoses shall normally be permitted between container valves and the manifold of the CO_2 containers.

Subsection 3. The internal diameter of CO_2 containers' connections to manifolds shall be at least 10 mm.

*Subsection 4.*The main stop valve shall be made of steel or similar approved material and be designed for a working pressure of 10 N/mm^2.

Release arrangement

Section 14. It shall be possible to manually open main stop valves locally 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.

Subsection 2. Any control arrangement shall be such that at least two manoeuvres shall be made to release the system.

Subsection 3. If the CO_2 quantity is released by means of direct manual operation of the container valve, the person operating the system shall be protected against any hose/pipe fracture.

Alarm system

Section 15. In a CO_2 protected space, acoustic alarms shall be fitted that will automatically sound before the first release manoeuvre is made. It shall be possible to register the alarm anywhere in the CO_2 protected space at the maximum noise level, and it shall not be possible to mistake it for other alarms.

Alarms shall be marked "CO_2 ALARM". However, small rooms (such as paint lockers, etc.) with only one local discharge point shall not be required to be fitted with such an alarm.

Subsection 2. Alarm signalling apparatuses operated by the released CO_2 cannot be approved as a prescribed alarm signalling apparatus in work spaces.

Special provisions

Section 16. All doors leading to CO_2 protected spaces shall be marked "This space is connected to a CO_2 system and must be left when the alarm sounds" (in Danish: "Rummet er tilsluttet CO_2-anlæg og skal forlades, når alarmudstyret træder i funktion").

Subsection 2. It shall be possible to secure the system against inadvertent release during stays in yards, etc., for example by inserting blind flanges (sliding flanges) just after the main stop valve.

Part 5

Penalty provisions, measures and entry into force, etc.

Section 17. Contraventions of this order shall be liable to punishment by fine or imprisonment for a term not exceeding 1 year.

Subsection 2. The penalty may be increased to imprisonment for a term not exceeding 2 years if

1) the contravention has caused harm to life or health or risk hereof;
2) a prohibition or order has previously been issued for the same or similar conditions; or
3) the contravention has achieved or been intended to achieve an economic advantage for the contravener or others.

Subsection 3. If the benefit obtained through the contravention is not confiscated, the size of such financial benefit obtained shall be taken into account when determining the fine, including additional fines.

Subsection 4. Companies, etc. (legal persons) may be liable to punishment in accordance with the provisions of part 5 of the penal code (*straffeloven*).

Section 18. If the condition is covered by the decree on the entry into force for Greenland of the act on safety at sea (*lov om sikkerhed til søs*), measures may be laid down in accordance with the penal code for Greenland.

Subsection 2. The conditions referred to in section 17(2) shall be considered aggravating circumstances.

Subsection 3. If the benefit obtained through the contravention is not confiscated, cf. part 37 of the penal code (*straffeloven*), the size of such financial benefit obtained or sought obtained shall be taken into account when determining the fine, including additional fines.

Subsection 4. If the contravention is committed by companies etc. (legal persons), liability to pay a fine may be incurred by the legal person as such. If the contravention is committed by the State, the Government of Greenland, a municipality, a municipal cooperative covered under section 64 of the Landsting act on municipal councils and local authorities, etc. or a local authority, liability to pay a fine may be incurred by the relevant public authority as such.

Subsection 5. If the relevant party is not resident in Greenland, or if his connection to Greenland society is otherwise so remote that the prerequisites for measures to be taken do not exist, legal proceedings may be instigated or the case may be referred for trial in Denmark.

Section 19. This order shall enter into force on 1 July 2014.

Section 20. This order shall not apply to the Faroe Islands.

Danish Maritime Authority, 13 June 2014
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