

(1) A fire detecting system of an approved type that is installed in accordance with §76.27 in subchapter H of this chapter; or

(2) A smoke detecting system of an approved type that is installed in accordance with §76.33 in subchapter H of this chapter.

(g) A partially enclosed vehicle space must be fitted with a manual sprinkler system that meets the requirements of §76.23 in subchapter H of this chapter.

[CGD 85-080, 61 FR 982, Jan. 10, 1996, as amended at 62 FR 51358, Sept. 30, 1997; USCG-1999-6216, 64 FR 53228, Oct. 1, 1999]

§ 181.410 Fixed gas fire extinguishing systems.

(a) *General.* (1) A fixed gas fire extinguishing system aboard a vessel must be approved by the Commandant, and be custom engineered to meet the requirements of this section unless the system meets the requirements of §181.420.

(2) System components must be listed and labeled by an independent laboratory. A component from a different system, even if from the same manufacturer, must not be used unless included in the approval of the installed system.

(3) System design and installation must be in accordance with the Marine Design, Installation, Operation, and Maintenance Manual approved for the system by the Commandant.

(4) A fixed gas fire extinguishing system may protect more than one space. The quantity of extinguishing agent must be at least sufficient for the space requiring the greatest quantity as determined by the requirements of paragraphs (f)(4) and (g)(2) of this section.

(b) *Controls.* (1) Controls and valves for operation of fixed gas fire extinguishing system must be:

(i) Located outside the space protected by the system; and

(ii) Not located in a space that might be inaccessible in the event of fire in the space protected by the system.

(2) Except for a normally unoccupied space of less than 170 cubic meters (6000 cubic feet), release of an extinguishing agent into a space must require two distinct operations.

(3) A system must have local manual controls at the storage cylinders capa-

ble of releasing the extinguishing agent. In addition, a normally manned space must have remote controls for releasing the extinguishing agent at the primary exit from the space.

(4) Remote controls must be located in a breakglass enclosure to preclude accidental discharge.

(5) Valves and controls must be of an approved type and protected from damage or accidental activation. A pull cable used to activate the system controls must be enclosed in conduit.

(6) A system protecting more than one space must have a manifold with a normally closed stop valve for each space protected.

(7) A gas actuated valve or device must be capable of manual override at the valve or device.

(8) A system, that has more than one storage cylinder for the extinguishing agent and that relies on pilot cylinders to activate the primary storage cylinders, must have at least two pilot cylinders. Local manual controls, in compliance with paragraph (b)(3) of this section, must be provided to operate the pilot cylinders but are not required for the primary storage cylinders.

(9) A system protecting a manned space must be fitted with an approved time delay and alarm arranged to require the alarm to sound for at least 20 seconds or the time necessary to escape from the space, whichever is greater, before the agent is released into the space. Alarms must be conspicuously and centrally located. The alarm must be powered by the extinguishing agent.

(10) A device must be provided to automatically shut down power ventilation serving the protected space and engines that draw intake air from the protected space prior to release of the extinguishing agent into the space.

(11) Controls and storage cylinders must not be in a locked space unless the key is in a breakglass type box conspicuously located adjacent to the space.

(c) *Storage space.* (1) Except as provided in paragraph (c)(2) of this section, a storage cylinder for a fixed gas extinguishing system must be:

(i) Located outside the space protected by the system; and

(ii) Not located in a space that might be inaccessible in the event of a fire in the space protected by the system.

(2) A normally unoccupied space of less than 170 cubic meters (6,000 cubic feet) may have the storage cylinders located within the space protected. When the storage cylinders are located in the space:

(i) The system must be capable of automatic operation by a heat actuator within the space; and

(ii) Have manual controls in compliance with paragraph (b) of this section except for paragraph (b)(3).

(3) A space containing a storage cylinder must be maintained at a temperature within the range from -30°C (-20°F) to 55°C (130°F) or at another temperature as listed by the independent laboratory and stated in the manufacturer's approved manual.

(4) A storage cylinder must be securely fastened, supported, and protected against damage.

(5) A storage cylinder must be accessible and capable of easy removal for recharging and inspection. Provisions must be available for weighing each storage cylinder in place.

(6) Where subject to moisture, a storage cylinder must be installed to provide a space of at least 51 millimeters (2 inches) between the deck and the bottom of the storage cylinder.

(7) A Halon 1301 storage cylinder must be stowed in an upright position unless otherwise listed by the independent laboratory. A carbon dioxide cylinder may be inclined not more than 30° from the vertical, unless fitted with flexible or bent siphon tubes, in which case they may be inclined not more than 80° from the vertical.

(8) Where a check valve is not fitted on an independent storage cylinder discharge, a plug or cap must be provided for closing the outlet resulting from storage cylinder removal.

(9) Each storage cylinder must meet the requirements of §147.60 in subchapter N of this chapter, or other standard specified by the Commandant.

(10) A storage cylinder space must have doors that open outwards or be fitted with kickout panels installed in each door.

(d) *Piping.* (1) A pipe, valve, or fitting of ferrous material must be protected

inside and outside against corrosion unless otherwise approved by the Commandant. Aluminum or other low melting material must not be used for a component of a fixed gas fire extinguishing system except as specifically approved by the Commandant.

(2) A distribution line must extend at least 51 millimeters (2 inches) beyond the last orifice and be closed with a cap or plug.

(3) Piping, valves, and fittings must be securely supported, and where necessary, protected against damage.

(4) Drains and dirt traps must be fitted where necessary to prevent the accumulation of dirt or moisture and located in accessible locations.

(5) Piping must be used for no other purpose except that it may be incorporated with the fire detecting system.

(6) Piping passing through accommodation spaces must not be fitted with drains or other openings within such spaces.

(7) Installation test requirements for carbon dioxide systems. The distribution piping of a carbon dioxide fixed gas extinguishing system must be tested as required by this paragraph, upon completion of the piping installation, using only carbon dioxide, compressed air, or nitrogen gas.

(i) Piping between a storage cylinder and a stop valve in the manifold must be subjected to a pressure of 6,894 kPa (1,000 psi), except as permitted in paragraph (d)(7)(iii) of this section. Without additional gas being introduced to the system, the pressure drop must not exceed 2,068 kPa (300 psi) after two minutes.

(ii) A distribution line to a space protected by the system must be subjected to a test similar to that described in paragraph (d)(7)(i) of this section except the pressure used must be 4,136 kPa (600 psi). For the purpose of this test, the distribution piping must be capped within the space protected at the first joint between the nozzles and the storage cylinders.

(iii) A small independent system protecting a space such as a paint locker may be tested by blowing out the piping with air at a pressure of not less than 689 kPa (100 psi) instead of the tests prescribed in the paragraphs (d)(7)(i) and (d)(7)(ii) of this section.

(8) Installation test requirements for Halon 1301 systems. The distribution piping of a Halon 1301 fixed gas extinguishing system must be tested, as required by this paragraph, upon completion of the piping installation, using only carbon dioxide, compressed air, or nitrogen.

(i) When pressurizing the piping, pressure must be increased in small increments. Each joint must be subjected to a soap bubble leak test, and all joints must be leak free.

(ii) Piping between the storage cylinders and the manifold stop valve must be subjected to a leak test conducted at a pressure of 4,136 kPa (600 psi). Without additional gas being added to the system, there must be no loss of pressure over a two minute period after thermal equilibrium is reached.

(iii) Distribution piping between the manifold stop valve and the first nozzle in the system must be capped and pneumatically tested for a period of 10 minutes at 1,034 kPa (150 psi). At the end of 10 minutes, the pressure drop must not exceed 10% of the test pressure.

(e) *Pressure relief.* When required by the cognizant OCMI, spaces that are protected by a fixed gas fire extinguishing system and that are relatively air tight, such as refrigeration spaces, paint lockers, etc., must be provided with suitable means for relieving excessive pressure within the space when the agent is released.

(f) *Specific requirements for carbon dioxide systems.* A custom engineered fixed gas fire extinguishing system, which uses carbon dioxide as the extinguishing agent, must meet the requirements of this paragraph.

(1) Piping, valves, and fittings must have a bursting pressure of not less than 41,360 kPa (6,000 psi). Piping, in nominal sizes of not more than 19 millimeters (0.75 inches), must be at least Schedule 40 (standard weight), and in nominal sizes of over 19 millimeters (0.75 inches), must be at least Schedule 80 (extra heavy).

(2) A pressure relief valve or equivalent set to relieve at between 16,550 and 19,300 kPa (2,400 and 2,800 psi) must be installed in the distribution manifold

to protect the piping from over-pressurization.

(3) Nozzles must be approved by the Commandant.

(4) When installed in a machinery space, paint locker, a space containing flammable liquid stores, or a space with a fuel tank, a fixed carbon dioxide system must meet the following requirements.

(i) The quantity of carbon dioxide in kilograms (pounds) that the system must be capable of providing to a space must not be less than the gross volume of the space divided by the appropriate factor given in Table 181.410(f)(4)(i). If fuel can drain from a space being protected to an adjacent space or if the spaces are not entirely separate, the volume of both spaces must be used to determine the quantity of carbon dioxide to be provided. The carbon dioxide must be arranged to discharge into both such spaces simultaneously.

TABLE 181.410(f)(4)(i)

Factor	Gross volume of space in cubic meters (feet)	
	Over	Not Over
0.94 (15)	14 (500)
1.0 (16)	14 (500)	45 (1,600)
1.1 (18)	45 (1,600)	125 (4,500)
1.2 (20)	125 (4,500)	1400 (50,000)
1.4 (22)	1400 (50,000)

(ii) The minimum size of a branch line to a space must be as noted in Table 181.410(f)(4)(ii).

TABLE 181.410(f)(4)(ii)

Maximum quantity of carbon dioxide required kg (lbs)	Minimum nominal pipe size mm (inches)
45.4 (100)	12.7 (0.5)
102 (225)	19 (0.75)
136 (300)	25 (1.0)
272 (600)	30 (1.25)
454 (1000)	40 (1.5)
1111 (2450)	50 (2.0)
1134 (2,500)	65 (2.5)
2018 (4,450)	75 (3.0)
3220 (7,100)	90 (3.5)
4739 (10,450)	100 (4.0)
6802 (15,000)	113 (4.5)

(iii) Distribution piping within a space must be proportioned from the distribution line to give proper supply to the outlets without throttling.

(iv) The number, type, and location of discharge outlets must provide uniform distribution of carbon dioxide throughout a space.

(v) The total area of all discharge outlets must not exceed 85 percent nor be less than 35 percent of the nominal cylinder outlet area or the area of the supply pipe, whichever is smaller. The nominal cylinder outlet area in square millimeters (inches) is determined by multiplying the factor 0.015 (0.0022 if using square inches) by the total capacity in kilograms (pounds) of all carbon dioxide cylinders in the system, except in no case must the outlet area be of less than 71 square millimeters (0.110 square inches if using pounds).

(vi) The discharge of at least 85 percent of the required amount of carbon dioxide must be completed within two minutes.

(5) When installed in an enclosed ventilation system for rotating electrical propulsion equipment a fixed carbon dioxide extinguishing system must meet the following requirements.

(i) The quantity of carbon dioxide in kilograms (pounds) must be sufficient for initial and delayed discharges as required by this paragraph. The initial discharge must be equal to the gross volume of the system divided by 160 (10 if using pounds) for ventilation systems having a volume of less than 57 cubic meters (2,000 cubic feet), or divided by 192 (12 if using pounds) for ventilation systems having a volume of at least 57 cubic meters (2,000 cubic feet). In addition, there must be sufficient carbon dioxide available to permit delayed discharges to maintain at least a 25 percent concentration until the equipment can be stopped. If the initial discharge achieves this concentration, a delayed discharge is not required.

(ii) The piping sizes for the initial discharge must be in accordance with Table 181.410(f)(4)(ii) and the discharge of the required amount must be completed within two minutes.

(iii) Piping for the delayed discharge must not be less than 12.7 millimeters (0.5 inches) nominal pipe size, and need not meet specific requirement for discharge rate.

(iv) Piping for the delayed discharge may be incorporated with the initial discharge piping.

(6) When installed in a cargo space a fixed carbon dioxide extinguishing system must meet the following requirements.

(i) The number of kilograms (pounds) of carbon dioxide required for each space in cubic meters (feet) must be equal to the gross volume of the space in cubic meters (feet) divided by 480 (30 if using pounds).

(ii) System piping must be of at least 19 millimeters (0.75 inches).

(iii) No specific discharge rate is required.

(g) *Specific requirements for Halon 1301 systems.* (1) A custom engineering fixed gas fire extinguishing system, which uses Halon 1301, must comply with the applicable sections of UL Standard 1058 "Halogenated Agent Extinguishing System Units," and the requirements of this paragraph.

(2) The Halon 1301 quantity and discharge requirements of UL 1058 apply, with the exception that the Halon 1301 design concentration must be 6 percent at the lowest ambient temperature expected in the space. If the lowest temperature is not known, a temperature of -18°C (0°F) must be assumed.

(3) Each storage cylinder in a system must have the same pressure and volume.

(4) Computer programs used in designing systems must have been approved by an independent laboratory.

NOTE TO §181.410(g): As of Jan. 1, 1994, the United States banned the production of Halon. The Environmental Protection Agency placed significant restrictions on the servicing and maintenance of systems containing Halon. Vessels operating on an international voyage, subject to SOLAS requirements, are prohibited from installing fixed gas fire extinguishing systems containing Halon.

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§ 181.420 Pre-engineered fixed gas fire extinguishing systems.

(a) A pre-engineered fixed gas fire extinguishing system must:

(1) Be approved by the Commandant;