MSC Guidelines for Fire Main Systems

Procedure Number: E1-09 Revision Date: 04/16/2018

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References

a. Title 46 CFR 34.10 (Subchapter D)

b. Title 46 CFR Part 56 (Subchapter F)

c. Title 46 CFR 76.10 (Subchapter H)

d. Title 46 CFR 95.10 (Subchapter I)

e. Title 46 CFR 108.415 (Subchapter I-A)

f. Title 46 CFR Part 118 (Subchapter K)

g. Title 46 CFR Part 119 (Subchapter K)

h. Title 46 CFR Part 128 (Subchapter L)

i. Title 46 CFR Part 132 (Subchapter L)

j. Title 46 CFR Part 181 (Subchapter T)

k. Title 46 CFR Part 182 (Subchapter T)

l. Navigation and Vessel Inspection Circular (NVIC) 6-72, "Guide to Fixed Fire Fighting Equipment aboard Merchant Vessels"

m. Safety of Life at Sea (SOLAS), Ch. II-2, Regulation 10

n. Commandant (G-MSE-4) Policy File Memorandum (PFM) 1-98, "Policy File Memorandum on the Performance Requirements for Plastic Pipe Per IMO Resolution A.753(18)

o. ASTM F1155-98, Standard Practice for Selection and Application of Piping Systems"

p. Marine Safety Center Technical Note (MTN) No. 02-10, "Material Selection for Vital Piping Systems"

q. D8(m) Policy Ltr 05-2004, "Use of Hose Reels with Non-Collapsible Hard-Rubber Fire Hoses on Floating Offshore Installations"

r. CG-ENG Policy Ltr 03-12, "Policy on the Implementation of IMO Resolution A.673 (16), Guidelines for the Transport and Handling of Limited Amounts of Hazardous and NLS in Bulk on OSVs, for New and Existing U.S. OSVs."

Contact Information

If you have any questions or comments concerning this document, please contact the Marine Safety Center by e-mail or phone. Please refer to Procedure Number: **E1-09.**

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Responsibilities

The submitter shall provide sufficient documentation and plans to indicate compliance with the applicable requirements. This includes piping and component material and design specifications, pump details, and arrangement plans. The submission shall be made in triplicate.

Table of Contents

46 CFR Subchapter D

General Information

- Fire pumps, piping, hydrants, hose and nozzles shall be installed on all tankships, the arrangements and details of which shall be as set forth in 46 CFR 34.10. (46 CFR 34.05-1)

- Installations contracted for prior to May 26, 1965, shall meet the requirements of 46 CFR 34.10-90. (46 CFR 34.10-1(a))

- If a fire main system is installed on a tank barge, the system shall meet the intent of 46 CFR 34.10 insofar as reasonable and practicable. (46 CFR 34.10-1(b))

Pumps

- Tankships shall be equipped with independently driven fire pumps in accordance with table 34.10-5(a).

Vsl Length (ft)	Pumps Req'd	Streams Req'd	Min. Ext. Stations (in)	Min. Int. Stations (in)
L ≤ 100	None	None	None	None
100 <L ≤ 250	1	2	1 ½	1 ½
250 <L ≤400	2	2	1 ½	1 ½
400 <L ≤ 650	2	2	[4]2 ½	1 ½
650 <L	2	3	[4]2 ½	1 ½

Table 34.10-5(a)

- Each pump shall be capable of delivering simultaneously the number of streams of water required by the table from the outlets having the greatest pressure drop between fire pump(s) and nozzles at a Pitot tube pressure of approximately 75 psi. (46 CFR 34.10-5(b))

1) **Note:** Where 1 ½ inch hose is permitted in lieu of 2 ½ inch hose by footnote 4 of Table 34.10-5(a), the pump capacity shall be determined on the basis that both hoses are used.

- Fire pumps may be used for other purposes provided at least one of the required pumps is kept available for use on the fire main system at all times. In no case shall a pump having connection to an oil line be used as a fire pump. Except for deck anchor washing services, the fire pump must be of sufficient capacity to satisfy the fire main and other connected services, simultaneously. (46 CFR 34.10-5(f))

- When two fire pumps are required, they must be in separate spaces. Pumps, sea connections, and sources of power must be arranged so that a fire in any one space will not put all of the fire pumps out of operation. (46 CFR 34.10-5(g))

  1) If it is unreasonable or impracticable to meet this requirement due to the size, or arrangement of the vessel, or for other reasons, a total flooding carbon dioxide system may be installed as an alternate method of extinguishing any fire which would affect the powering and operation of at least one of the required fire pumps.

  2) See Attachment 1: Fire Pump Location & Separation of Spaces.

- Fire pumps shall be fitted on the discharge side with a pressure gage and with relief valves set to relieve at 25 psi in excess of the pressure necessary to maintain the required pressure. (46 CFR 34.10-5(d) & (e))

Hydrants

- Fire station hydrant connections shall be brass, bronze, or other equivalent metal. (46 CFR 34.10-10(i))

- Each hydrant or Y branch shall be equipped with a valve so that the hose may be removed while there is pressure on the fire main. (46 CFR 34.10-10(h))

- The size of the fire hydrants, hoses and nozzles shall be in accordance with Table 34.10-5(a).

- Number and location of hydrants must be sufficient to allow any part of living quarters, storerooms, working spaces and weather decks accessible to crew while at sea to be reached with TWO effective spray patterns of

water, ONE of which shall be from a SINGLE 50-foot length of hose. (46 CFR 34.10-10(b))

- In main machinery spaces ALL portions of such spaces must be reachable by at least TWO effective spray patterns of water, BOTH of which shall be from a SINGLE 50-foot length of hose from SEPARATE outlets. (46 CFR 34.10-10(b))

- Couplings shall either use 1 ½ inch and 2 ½ inch National Standard fire hose coupling threads (9 threads per inch for 1 ½ inch hose and 7.5 threads per inch for 2 ½ inch hose be a uniform design for each hose diameter throughout the vessel. (46 CFR 34.10-10(i))

- Check that all hydrants are readily accessible (i.e. not between narrow bulkheads, behind engines, under deckplates, etc.; hydrants shall be so placed that the fire hose may be easily coupled to them. (46 CFR 34.10-10(g))

- If deck cargo is carried, it shall not interfere with access to the fire station hydrants, and the pipes shall be arranged as far as practicable to avoid risk of damage by such cargo. (46 CFR 34.10-10(g))

Hoses and Nozzles

- Fire hose shall be 50 feet in length. Exception: on weather decks the hose shall be increased in length if necessary to enable a single length to be goose-necked over each side of the vessel. If two fire mains are installed on the weather decks, the length of hose shall be such that it may be goose-necked over the side from the nearest fire main. (46 CFR 34.10-10(j))

- Each section of fire hose must be lined commercial fire hose that conforms to Underwriters' Laboratories, Inc. Standard 19 or Federal Specification ZZ-H-451E. **Note:** Hose that bears the label of Underwriters' Laboratories, Inc. as lined fire hose is accepted as conforming to this requirement. (46 CFR 34.10-10(m))

- Each fire hose at a hydrant must have a combination solid stream and water spray firehose nozzle that meets the requirements in 46 CFR 162.027. (46 CFR 34.10-10(e))

- Fire hose nozzles previously approved under 46 CFR 162.027 may be retained so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. (46 CFR 34.10-10(e))

Piping

- Pipe and fittings shall conform to the material specifications listed in Table 56.60-1(a) of 46 CFR 56.60, or may be selected from the material specifications of Sections I or VIII of ASME Boiler and Pressure Vessel Code or reference (o). (46 CFR 34.10-15(a) and reference (p)))
    - Ferrous piping used in salt water service must be protected against corrosion by hotdip galvanized or extra heavy schedule. (46 CFR 56.60-3(a))
- Fittings and valves shall conform to an appropriate design standard listed in Table 56.60-1(b) or other acceptable standard which provides an equivalent level of safety. Fitting and valve class/pressure rating must be adequate for the application.. (46 CFR 34.10-15(a))
- An adequate number of valves shall be installed to isolate damaged sections of piping. **Except on:** Self-propelled vessels carrying bulk liquefied gases must have stop valves: (46 CFR 34.10-15(b))

    1) At cross connections;

    2) At the front of the after deck house; and

    3) In the cargo area spaced 40 m (131 ft.) or less between hydrants.

Additional Requirements for Subchapter D Vessels on an International Voyage

Pumps

- On tankships of 1,000 gross tons and over, each required pump shall have a minimum capacity of at least two-thirds of that required for an independent bilge pump if no length correction is taken for the cargo tank space. This capacity requirement must be met while delivering water through the fire main system at the pressure described below. In no case can the capacity be less than otherwise required in 46 CFR Part 34. (46 CFR 34.10-5(c))

Fire Main

- The diameter of the fire main, on tank ships on an international voyage, shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously. The discharge of

this quantity of water through hoses and nozzles at a sufficient number of adjacent hydrants shall be a minimum of approximately 71 psi on self-propelled vessels that carry bulk liquefied gases and approximately 50 psi on other tankships. Note: This requirement is in addition to 46 CFR 34.10-5(b). (46 CFR 34.10-15(e))

- Tankships of 500 gross tons and over must be provided with at least one international shore connection which meets ASTM F1121. Facilities must be available enabling an international shore connection to be used on either side of the vessel. (46 CFR 34.10-15(d))

SOLAS

- Vessels on an international voyage must meet SOLAS requirements. See Attachment 2 located at the end of this document for guidance.

46 CFR Subchapter H

Pumps

- Vessels shall be equipped with independently driven fire pumps in accordance with 46 CFR Table 76.10-5(a).

Vsl Tonnage	Pumps Req'd	Min. Hose & Hydrant (in)
GT ≤ 100	1	1 ½
100 <GT ≤ 250	1	1 ½
500 <GT ≤1500	2	1 ½
1500 < GT ≤ 4000	2	2 ½
4000 <GT	3	2 ½

Table 76.10-5(a)

- Each pump shall be capable of delivering water simultaneously from the two highest outlets at a Pitot tube pressure of approximately 50 psi (46 CFR 76.10-5(c))

- Fire pumps shall be fitted with a pressure gage on the discharge side of the pumps (46 CFR 76.10-5(e))

- Fire pumps may be used for other purposes provided at least one of the required pumps is kept available for use on the fire main system at all times. In no case shall a pump having connection to an oil line be used as a fire pump. (46 CFR 76.10-5(f))

- Branch lines connected to the fire main for purposes other than fire and deck wash shall be so arranged that the required pressure and capacities of the fire pump and any other services installed on the fire main can be met simultaneously. (46 CFR 76.10-5(f))

- The total area of the pipes leading from a pump shall not be less than the discharge area of the pump. (46 CFR 76.10-5(g))

- On vessels with oil fired boilers, either main or auxiliary, or with internal combustion propulsion machinery, when two fire pumps are required, they must be in separate spaces. Pumps, sea connections, and sources of power must be arranged so that a fire in any one space will not put all of the fire pumps out of operation. (46 CFR 76.10-5(h))

    1) For vessels of less than 300 feet in length, if it is unreasonable or impracticable to meet this requirement due to the size, or arrangement of the vessel, or for other reasons, a total flooding carbon dioxide system may be installed as an alternate method of extinguishing any fire which would affect the powering and operation of at least one of the required fire pumps. (46 CFR 76-10.5(h))

    2) See Attachment 1: Fire Pump Location & Separation of Spaces.

- Fire pumps shall be fitted on the discharge side with relief valves set to relieve at 25 psi in excess of the pressure above or 125 psi., whichever is greater. Relief valves may be omitted if the pumps, operating under shut-off conditions, are not capable of developing a pressure exceeding this amount. (46 CFR 76.10-5(d)) Pump shut off pressure may be verified on a pump curve.

Fire Station Hydrants, Hose and Nozzles

- The outlet at each fire hydrant shall be provided with a cock or valve fitted in such a position that the fire hose may be removed while the fire main is under pressure. (46 CFR 76.10-10(f))

- The size of fire hydrants, hose, and nozzles and the length of hose required shall be as noted in 46 CFR Table 76.10-5(a). (46 CFR 76.10-10(a))

- Number and location of hydrants must be so that any part of the vessel, other than main machinery spaces and cargo holds, accessible to the passengers or crew while the vessel is being navigated and all cargo holds may be reached with at least TWO streams of water from SEPARATE outlets, at least ONE of which shall be from a SINGLE length of hose. (46 CFR 76.10-10(d))

    1) For the purpose of this requirement, all watertight doors and all doors in main vertical zone bulkheads and stairway enclosures shall be closed, although hose ports may be installed in doors other than watertight doors and doors in main vertical zone bulkheads for the passage of the hose.

2) In main machinery spaces, all portions of the space must be reachable by at least TWO streams of water, EACH of which shall be from SINGLE lengths of hose from SEPARATE outlets. (46 CFR 76.10-10(d))

3) This requirement need not apply to shaft alleys containing no assigned space for the stowage of combustibles. (46 CFR 76.10-10(d))

4) On vessels over 1500 GT, where 46 CFR table 76.10-5(a) specifies the use of 2 ½ inch hose and hydrants, the hydrants in interior locations may have wye connections for 1 ½ inch hose. In these cases the hose must be 75 feet in length, and only one hose will be required at each fire station; however, if all such stations can be satisfactorily served with 50-foot lengths, 50-foot hose may be used; and the hydrants for external locations may consist of two 1 ½ inch outlets; each with a 1 ½ inch hose, supplied through a wye connection as a substitute. (46 CFR 76.10-10(b))

- On vessels of 500 gross tons and over there must be at least one shore connection to the fire main available on each side of the vessel in an accessible location. (46 CFR 76.10-10(c))

  1) Suitable cut-out valves and check valves must be provided for shore connections. (46 CFR 76.10-10(c))

  2) Suitable adaptors must be provided for furnishing the vessel's shore connections with couplings mating those on the shore fire lines. (46 CFR 76.10-10(c))

- All parts of the fire main located on exposed decks shall either be protected against freezing or be fitted with cut-out valves and drain valves so that the entire exposed parts of such piping may be shut off and drained in freezing weather. Except when closed to prevent freezing, such valves must be sealed open. (46 CFR 76.10-10(e))

- Fire station hydrant connections shall be brass, bronze, or other equivalent metal. (46 CFR 76.10-10(n)(1))

  1) Couplings shall either use 1 ½ inch and 2 ½ inch National Standard fire hose coupling threads (9 threads per inch for 1 ½ inch hose and 7.5 threads per inch for 2 ½ inch hose); or be a uniform design for each hose diameter throughout the vessel. (46 CFR 76.10-10(n)(1)(i)&(ii))

- The minimum size orifice for fire hose nozzles shall be as specified by 46 CFR Table 76.10-5(a).

- Fire hose nozzles previously approved under 46 CFR 162.027 may be retained so long as they are maintained in good condition to the satisfaction of the OCMI.

    1) Accommodation and service areas must have two fire hoses with low-velocity water spray applicators. (46 CFR 76.10-10(k)(1))

    2) Each fire hose, on a vessel 1000 GT or more, in propulsion machinery spaces containing an oil-fired boiler, internal combustion machinery, or oil fuel unit must have a low-velocity water spray applicator of not more than 1.8 meters (6 feet) (46 CFR 76.10-10(k)(2))

- Each section of fire hose must be lined commercial fire hose that conforms to Underwriters' Laboratories, Inc. Standard 19 or Federal Specification ZZ-H-451E. Hose that bears the label of Underwriters' Lab of Underwriters' Laboratories, Inc. as lined fire hose is accepted as conforming to this requirement. (46 CFR 76.10-10(n)(2))

Piping

- Materials used in piping systems must be selected from the specifications that appear in Table 56.60-1(a) or Table 56.60-2(a), or they may be selected from the material specifications ofSections I or VIII of ASME Boiler and Pressure Vessel Code or reference (o). (46 CFR 76.10-15(a) and reference (p)))

    - Ferrous piping used in salt water service should be galvanized or extra heavy schedule. (46 CFR 56.60-3(a))

- Fittings and valves shall conform to an appropriate design standard listed in Table 56.60-1(b) or other acceptable standard which provides an equivalent level of safety. Fitting and valve class/pressure rating must be adequate for the application. (46 CFR 76.10-15(a))

Additional Requirements for Subchapter H Vessels on an International Voyage

Pumps

- Vessels on an international voyage shall have a minimum total fire pump capacity at least equal to two-thirds of the required total bilge pump capacity, but in no case less than that required by 46 CFR 76.10-5(a). (46 CFR 76.10-5(b))

- Each of the required fire pumps on vessels on an international voyage shall have a capacity not less than 80 percent of the total required capacity divided by the number of required pumps. (46 CFR 76.10-5(b))

Hydrants and Hoses

- Vessels 500 gross tons and over on an international voyage, must be provided with at least one international shore connection complying with ASTM F-1121. (46 CFR 76.10-10(c))

- Facilities must be available enabling an international shore connection to be used on either side of the vessel. (46 CFR 76.10-10(c))

Fire Main

- The diameter of the fire main on vessels on an international voyage shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously. **Note:** This is in addition to 76.10-5(c). The discharge of this quantity of water through hoses and nozzles at a sufficient number of adjacent hydrants shall be at a minimum Pitot tube pressure of approximately 50 psi. (46 CFR 76.10-15(c))

SOLAS

- Vessels on an international voyage must meet SOLAS requirements. See Attachment 2 located at the end of this document for guidance.

46 CFR Subchapter I

- Number of fire pumps and minimum hose hydrant size per vessel:

Vsl Tonnage	Pumps Req'd	Min. Hose & Hydrant (in)
GT ≤ 100	1*	1 ½*
100 <GT ≤ 1000	1	1 ½
1000 <GT ≤1500	2	1 ½
1500 < GT	2	2 ½**

Table 95.10-5(a))

Vessels not over 100 GT and 65' or less in length

Pumps

- *The fire pump may be hand operated for vessels 65' in length or less. (Note 1 of 46 CFR Table 95.10-5(a))

Fire Main, Hydrants, and Hoses

- *On vessels of 65' in length or less, ¾ inch hose of a good commercial grade together with a commercial garden hose nozzle may be used. (Note 1 of 46 CFR Table 95.10-5(a))
- Where ¾ inch hose is permitted, the Pitot tube pressure need be only 35 psi. (46 CFR 95.10-5(c))
- *On vessels of 65' in length or less, the length of hose shall be sufficient to assure coverage of all parts of the vessel. (Note 1 of 46 CFR Table 95.10-5(a))

Vessels under 100 GT and over 65' in length/Vessels over 100 GT

Fire Pumps

- Fire pumps, hydrants, hose, and nozzles shall be installed on all self-propelled vessels and all barges with sleeping accommodations for more than 12 shall be as listed in Table 95.10-5(a)). (46 CFR 95.05-5)

- Each pump shall be capable of delivering water simultaneously from the two highest outlets at a Pitot tube pressure of approximately 50 psi. (46 CFR 95.10-5(c))

- Where 1 ½ inch hose is permitted in lieu of 2 ½ inch hose by footnote 2 (**) of Table 95.10-5(a), the pump capacity must be determined on the same basis as if 2 ½ inch hose has been permitted. (46 CFR 95.10-5(c))

- The total area of the pipes leading from a pump shall not be less than the discharge area of the pump. (46 CFR 95.10-5(g))

- Fire pumps may be used for other purposes provided at least one of the required pumps is kept available for use on the fire main system at all times. In no case shall a pump having connection to an oil line be used as a fire pump. Except for deck anchor washing services, the fire pump must be of sufficient capacity to satisfy the fire main and other connected services, simultaneously. (46CFR 95.10-5(f))

- On vessels with oil fired boilers, either main or auxiliary, or with internal combustion propulsion machinery, when two fire pumps are required, they must be in separate spaces. Pumps, sea connections, and sources of power must be arranged so that a fire in any one space will not put all of the fire pumps out of operation. (46 CFR 95.10-5(h))

    1) If it is unreasonable or impracticable to meet this requirement due to the size, or arrangement of the vessel, or for other reasons, a total flooding carbon dioxide system may be installed as an alternate method of extinguishing any fire which would affect the powering and operation of at least one of the required fire pumps.

    2) See Attachment 1: Fire Pump Location & Separation of Spaces.

- Fire pumps shall be fitted on the discharge side with a pressure gage and with relief valves set to relieve at 25 psi in excess of the pressure necessary to maintain the requirements above or 125 psi, whichever is greater (46

CFR 95.10-5(d)&(e)). Relief valves may be omitted if the pumps, operating under shut-off conditions, are not capable of developing a pressure exceeding this amount.

Fire Main and Hydrants

- Fire station hydrant connections shall be brass, bronze, or other equivalent metal. (46 CFR 95.10-10(n)(1))
- Number and location of hydrants must be so that any part of the vessel, other than main machinery spaces, accessible to persons on board while the vessel is being navigated and all cargo holds may be reached with at least TWO streams of water from SEPARATE outlets, at least ONE of which shall be from a SINGLE length of hose. (46 CFR 95.10-10(d))
- In main machinery spaces, all portions of the space shall be reachable by at least TWO streams of water, BOTH of which shall be from a SINGLE length of hose from SEPARATE outlets. This requirement need not apply to shaft alleys containing no assigned space for the stowage of combustibles. (46 CFR 95.10-10(d))
- Fire hydrants, nozzles, and other fittings shall have threads to accommodate the hose connections required in 46 CFR 95.10-10(l). (46 CFR 95.10-10(m))
- All parts of the fire main located on exposed decks shall either be protected against freezing or be fitted with cut-out valves and drain valves so that the entire exposed parts of such piping may be shut off and drained in freezing weather. Except when closed to prevent freezing, such valves shall be sealed open. (46 CFR 95.10-10(e))
- On vessels of 500 gross tons and over there must be at least one shore connection to the fire main available to each side of the vessel in an accessible location. (46 CFR 95.10-10(c))
- Suitable cut-out valves and check valves must be provided for required shore connections. (46 CFR 95.10-10(c))
- Suitable adapters must be provided for furnishing the vessel's shore connections with couplings mating those on the shore fire lines. (46 CFR 95.10-10(c))

Hose and Nozzles

- The size of fire hydrants, hose, and nozzles shall be as noted in 46 CFR Table 95.10-5(a). Hose length of 50 feet are required except for vessels over 1500 GT where 1 ½ wye connections are used in interior locations in lieu of 2 ½ inch connections; in these cases, 75 foot hoses are acceptable. (46 CFR 95.10-10(b))
    - For exterior hose stations, a wye connections with two 1 ½ hoses may be used in lieu of a single 2 ½ inch hose. These hose arrangements are acceptable regardless of vessel route. (46 CFR 95.10-10(b)(2))
- Couplings shall either use 1 ½ inch and 2 ½ inch National Standard fire hose coupling threads (9 threads per inch for 1 ½ inch hose and 7.5 threads per inch for 2 ½ inch hose); or be a uniform design for each hose diameter throughout the vessel. (46 CFR 95.10-10(n)(1)(i))
- Each section of fire hose must be lined commercial firehose that conforms to Underwriters' Laboratories, Inc. Standard 19 or Federal Specification ZZ-H-451E. Hose that bears the label of Underwriters' Laboratories, Inc. as lined firehose is accepted as conforming to this requirement. (46 CFR 95.10-10(n)(3))

Piping

- Materials used in piping systems must be selected from the specifications that appear in Table 56.60-1(a) or Table 56.60-2(a), or they may be selected from the material specifications of Sections I or VIII of ASME Boiler and Pressure Vessel Code or reference (o). (46 CFR 95.10-15(a) and reference (p))
    - Ferrous piping used in salt water service should be galvanized or extra heavy schedule. (46 CFR 56.60-3(a))
- Fittings and valves shall conform to an appropriate design standard listed in Table 56.60-1(b) or other acceptable standard which provides an equivalent level of safety. Fitting and valve class/pressure rating must be adequate for the application.. (46 CFR 95.10-15(a))

Additional Requirements for Subchapter I Vessels on an International Voyage

Pumps

- On vessels of 1,000 gross tons and over on an international voyage, each required fire pump, while delivering water thru the fire main system at 50 psi simultaneously to the two highest outlets, shall have a minimum capacity of at least two-thirds of that required for an independent bilge pump. In no case shall the capacity of each fire pump be less than that otherwise required by 46 CFR 95.10-5(a). (46 CFR 95.10-5(b))

Fire Main

- The diameter of the fire main on vessels on an international voyage shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously. This requirement is in addition to 95.10-5(c). The discharge of this quantity of water through hoses and nozzles at a sufficient number of adjacent hydrants shall be at a minimum Pitot tube pressure of approximately 50 psi. (46 CFR 95.10-15(c))

Hydrants and Hose

- Vessels of 500 gross tons and over on an international voyage, must be provided with at least one international shore connection complying with ASTM F-1121. (46 CFR 95.10-10(c))

- Facilities must be available enabling an international connection to be used on either side of the vessel. (46 CFR 95.10-10(c))

- In each propulsion machinery space containing an oil fired boiler, internal combustion machinery, or oil fuel unit on a vessel on an international voyage or of 1000 gross tons or more, each fire hose having a combination nozzle previously approved under 46 CFR 162.027 must have a low-velocity water spray applicator that is also previously approved under 162.027. The length of the applicator must be less than 6 feet. (46 CFR 95.10-10(j))

SOLAS

- Vessels on an international voyage must meet SOLAS requirements. See Attachment 2 located at the end of this document for assistance.

46 CFR Subchapter I-A

Pumps

- A fire main system must have at least two independently driven fire pumps that can each deliver water at a continuous Pitot tube pressure of approximately 50 psi through at least two fire hose nozzles that are connected to the highest two fire hydrants on the unit. Alternative designs that meet the pressure requirement will be considered for column stabilized and self elevating units. (46 CFR 108.415))

- If a fire pump is used in a system other than the fire main system, except for branch lines connected to the fire main for deck washing, each pipe connecting the other system must be connected to the pump discharge through a shut off valve at a manifold near the pump. (46 CFR 108.417(c))

- Each fire pump and its source of power, controls, sea connections for the fire pump, and booster pumps, if installed, must be installed in locations where, if a fire occurs in an enclosed space, all of the fire pumps on the unit are not made inoperative. If compliance with this requirement is impracticable, a gas type extinguishing system may be installed to protect at least one of the fire pumps, its source of power, and controls. (46 CFR 108.421)

- Fire pumps may be used for other purposes provided one of the required pumps is kept available for use on the fire main system at all times; however, pumps connected to oil lines shall not be used as a fire pump. (46 CFR 108.417(c)&(e))

- Each fire pump in a fire main system must have on its discharge side a pressure gauge and relief valve that is set to relieve at approximately 25 psi in excess of the pump discharge pressure necessary to meet the 50 psi pressure required above, or 125 psi, whichever is greater. Relief valves may be omitted if the pump operating under shut off condition is not capable of developing this pressure. (46 CFR 108.417(a))

- If the fire pump exceeds the pressure in 46 CFR 108.417(a), the pipe leading from the discharge manifold to other portions of the fire main system must have a reducing station and a pressure gauge in addition to the pressure gauge required by 46 CFR 108.417(b). (46 CFR 108.417(c))

- If a fire pump has a reducing station, the pump relief valve and additional pressure gauge must not be located on the discharge side of the reducing station. (46 CFR 108.417(d))

Fire Main and Hydrants

- The diameter of the fire main must be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously. (46 CFR 108.419)

- A fire main system must have enough fire hydrants so that each accessible space may be sprayed with at least two spray patterns of water. (46 CFR 108.423(a))

    1) In a main machinery space, except a shaft alley with no assigned space for stowage of combustibles, each of the TWO required spray patterns of water must be from ONE length of fire hose and each must be from a SEPARATE outlet. (46 CFR 108.423(b))

    2) In other than machinery spaces, at least ONE of the two required spray patterns of water must be from ONE length of fire hose. (46 CFR 108.423(b))

- Each part of the fire main system located on an exposed deck must either be protected against freezing or be fitted with cutout valves and drain valves to shut off and drain the entire exposed system in freezing weather. (46 CFR 108.429(b))

- Each pipe and fire hydrant in a fire main system must be installed to the extent practicable in locations that are not exposed to damage by materials that are moved on or onto the deck. (46 CFR 108.429(a))

Hose and Nozzles

- Fire station hydrant connections shall be brass, bronze, or other equivalent metal. (46 CFR 108.425(b))

- Hose and hydrant couplings shall either use 1 ½ inch and 2 ½ inch National Standard fire hose coupling threads (9 threads per inch for 1 ½ inch hose and 7.5 threads per inch for 2 ½ inch hose); or,be a uniform design for each hose diameter throughout the vessel. (46 CFR 108.425(b))

- Each nozzle for a firehose in a fire main system must be a combination solid stream and water spray firehose nozzle that is approved under 46 CFR

162.027. **Note**: Combination solid stream and water spray nozzles previously approved under 162.027 may be retained so long as they are maintained in good condition to the satisfaction of the OCMI. (46 CFR 108.425(c))

- A combination solid stream and water spray firehose nozzle previously approved under 46 CFR 162.027 must have a low-velocity water spray applicator also previously approved under 162.027 when installed in machinery spaces containing oil fired boilers, internal combustion machinery or oil fuel units; and on helicopter decks. (46 CFR 108.425(d))

- Each length of fire hose in a fire main system must be of 1 ½ or 2 ½ inch nominal hose size diameter, of 50 foot nominal hose size length, and lined commercial fire hose that meets Standard 19 of the Underwriters' Laboratories, Inc., or Federal Specification ZZ-H-451f. (46 CFR 108.425(a))

- Non collapsible hose reel stations which are USCG Type Approved under Class 162.033 for fire main service are acceptable for the protection of open deck areas, columns, pontoons, and machinery spaces where there is sufficient room to unreel the hoses. (Reference (q)4)

Piping

- Materials used in piping systems must be selected from the specifications that appear in Table 56.60-1(a) or Table 56.60-2(a), or they may be selected from the material specifications of Sections I or VIII of ASME Boiler and Pressure Vessel Code or reference (o). (46 CFR 107.305(z) and reference (p))

    - Ferrous piping used in salt water service should be galvanized or extra heavy schedule. (46 CFR 56.60-3(a))

- Fittings and valves shall conform to an appropriate design standard listed in Table 56.60-1(b) or other acceptable standard which provides an equivalent level of safety. Fitting and valve class/pressure rating must be adequate for the application.. (Reference (p))

- Non metallic piping meeting the following requirements is acceptable for use in MODU and OCS facilities fire main and deluge systems in lieu of meeting the Level 1 or Level 2 fire endurance requirements of IMO A.753(18). (Reference (n))

1) Fire main

i. Piping must meet Level 3 or higher fire endurance test as outlined in IMO A.753(18). USCG Type approval is required.

ii. The piping must be located on the exterior perimeter of the platform and shielded from potential fire and blast.

iii. The piping must be located so that pooling of flammable liquids below the pipe is not a possible

iv. The pipe must be located in a wet portion of the fire main.

v. Adequate isolation valves must be located within the fiberglass piping loop to allow isolation of damaged sections while allowing continued use of the fire main.

2) Deluge Systems

i. Piping must be located on open deck or semi-enclosed locations.

ii. Piping must meet Level 3 **WET/DRY** or higher fire endurance test as outlined in IMO A.753(18). USCG Type approval is required.

iii. The area protected by the deluge system must be protected by an automatic fire detection system.

iv. The deluge system must be automatically activated by the fire detection system.

v. Each section or area protected by the deluge system must be capable of being isolated by a single water supply valve.

vi. Means shall be provided for preventing unauthorized operation of the water supply valves.

vii. The system must be capable of flowing water to the most remote zone within one minute of fire detection.

viii. The fiberglass piping must be located downstream of the water supply valve. Piping located upstream of the valve must comply with appendix 4 of IMO Resolution A.753(18).

Additional Requirements for Subchapter I-A Vessels on an International Voyage

Fire Main

- A fire main system on a unit in international service must have at least one international shore connection that meets ASTM F-1121. (46 CFR 108.427(a))
- A fire main system on a unit in international service must have a cutoff valve and check valve for each shore connection. (46 CFR 108.427(b))
- A fire main system on a unit in international service must have facilities available enabling the international shore connection to be used on either side of the unit. (46 CFR 108.427(c))

SOLAS

- Vessels on an international voyage must meet SOLAS requirements. See Attachment 2 located at the end of this document for assistance.

46 CFR Subchapter K

Vessels less than 100 GT, carrying 150 to 600 passengers, with overnight accommodations for not more than 49

Pumps

- At least one self-priming, power driven fire pump must be installed on each vessel. (46 CFR 118.300(a))
- The fire pump must be capable of delivering a single hose stream from the highest hydrant, through the required hose and nozzle, at a Pitot tube pressure of 50 psi. (46 CFR 118.300(b))
- A fire pump may be driven by a propulsion engine. A fire pump must be permanently connected to the fire main and may be connected to the bilge system to meet the requirements of 46 CFR 119.520. (46 CFR 118.300(d))
- The fire pump must be capable of both remote operation from the operating station and local operations at the pump. (46 CFR 118.300(e))

Fire Main and Hydrants

- Piping, valves, and fittings in a fire main system must comply with 46 CFR Part 119 Subpart G. (46 CFR 118.310(b))
- Each fire hydrant must have a valve installed to allow the fire hose to be removed while the fire main is under pressure. (46 CFR 118.310(c))
- The vessel must have a sufficient number of fire hydrants to reach ANY part of the vessel using a SINGLE length of fire hose. (46 CFR 118.310(a))

Hose and Nozzles

- Fire hose nozzles must be of a type approved in accordance with 46 CFR 162.027; or be of a type recognized by the Commandant as being equivalent in performance. (46 CFR 118.320(c)(1)&(2))
- Fire hoses fittings must be of brass or other suitable corrosion-resistant material that comply with National Fire Protection Association (NFPA)

1963 “Standard for Fire Hose Connections,” or other standard specified by the Commandant. (46 CFR 118.320(b)(3))

- Fire hoses must be commercial lined conforming to Underwriters Laboratory (UL) 19 “Lined Fire Hose and Hose Assemblies,” or be listed and labeled by an independent laboratory recognized by the Commandant as being equivalent in performance. (46 CFR 118.320(b)(1))

- Fire hoses must be 50 feet in length and 1 ½ inches in diameter. (46 CFR 118.320(b)(2))

- A fire hose with a nozzle must be attached to each fire hydrant at all times. (46 CFR 118.320(a))

Piping

- Piping materials shall be in accordance with 46 CFR 56.60, except that nonferrous metallic piping as specified in 46 CFR 119.730. (46 CFR 119.710(c))

  1) Ferrous piping used in salt water service should be galvanized or extra heavy schedule. (46 CFR 56.60-3(a))

  2) If acceptable to the cognizant OCMI, nonferrous metallic piping with a melting temperature above 927 deg. C (1,700 deg. F) that are deemed to be galvanically compatible may be used in fire main systems. (46 CFR 119.730(a)(4))

  3) Aluminum firemain piping on an aluminum hulled vessel is acceptable. (46 CFR 119.730(a)(3))

  4) Non-metallic piping, fittings and pressure containing components must be in accordance with IMO Resolution A.753(18) and IMO Resolution MSC.313(88). (46 CFR 119.720 & 46 CFR 56.60-25) Generally, this precludes the use non-metallic piping and pressure containing components (e.g. strainers with plastic or acrylic bowls)

- Provisions must be made to protect piping systems using aluminum alloys in high risk fire areas due to the low melting point of aluminum alloys. (46 CFR 119.730(b)(1)) (MSC recognizes fixed CO_2 systems)

Vessels carrying more than 600 passengers or having overnight accommodations for more than 49

Pumps

- At least one self-priming, power driven fire pump must be installed. The pump must be capable of delivering water simultaneously from the two highest outlets at a Pitot tube pressure of approximately 50 psi. (46 CFR 118.300(c) & 46 CFR 76.10-5(a),(c))

- Vessels on an international voyage shall have a minimum total fire pump capacity at least equal to two-thirds of the required total bilge pump capacity, but in no case less than that required per 46 CFR 76.10-5. (46 CFR 118.300(c) & 46 CFR 76.10-5(b))

- Branch lines connected to the fire main for purposes other than fire and deck wash shall be so arranged that the required pressure and capacities of the fire pump and any other services installed on the fire main can be met simultaneously. (46 CFR 118.300(c) & 46 CFR 76.10-5(f))

- The total area of the pipes leading from a pump shall not be less than the discharge area of the pump. (46 CFR 118.300(c) & 46 CFR 76.10-5(g))

- On vessels with oil fired boilers, either main or auxiliary, or with internal combustion propulsion machinery, when two fire pumps are required, they must be in separate spaces. Pumps, sea connections, and sources of power must be arranged so that a fire in any one space will not put all of the fire pumps out of operation. (46 CFR 118.300(c) & 46 CFR 76.10-5(h))

  1) For vessels less than 300 feet in length, if it is unreasonable or impracticable to meet this requirement due to the size, or arrangement of the vessel, or for other reasons, a total flooding carbon dioxide system may be installed as an alternate method of extinguishing any fire which would affect the powering and operation of at least one of the required fire pumps.

  2) See Attachment 1: Fire Pump Location & Separation of Spaces.

- Fire pumps may be used for other purposes provided at least one of the required pumps is kept available for use on the fire system at all times; however, pumps connected to oil lines may not be used as a fire pump. (46 CFR 118.300(c) & 46 CFR 76.10-5(f))

- Fire pumps shall be fitted on the discharge side with pressure gauges and with relief valves set to relieve at 25 psi in excess of the pressure necessary to maintain the pressure of 46 CFR 76.10-5(c), or 125 psi., whichever is greater. Relief valves may be omitted if the pumps, operating under shut-off conditions, are not capable of developing a pressure exceeding this amount. (46 CFR 118.300(c) & 46 CFR 76.10-5(d) & (e))

Fire Main and Hydrants

- The outlet at each fire hydrant shall be provided with a cock or valve fitted in such a position that the fire hose may be removed while the fire main is under pressure. (46 CFR 118.310(d) & 46 CFR 76.10-10(f))

- Fire hydrants shall be of sufficient number and so located that any part of the vessel, other than main machinery spaces, accessible to the passengers or crew while the vessel is being navigated and all cargo holds may be reached with at least TWO streams of water from SEPARATE outlets, at least ONE of which shall be from a SINGLE length of hose. (46 CFR 118.310(d) & 46 CFR 76.10-10(d)).

    1) For the purpose of this requirement, all watertight doors and all doors in main vertical zone bulkheads and stairway enclosures shall be closed, although hose ports may be installed in doors other than watertight doors and doors in main vertical zone bulkheads for the passage of the hose.

    2) In main machinery spaces, all portions at such spaces shall be reachable by at least TWO streams of water, BOTH of which shall be from a SINGLE length of hose from SEPARATE outlets; however, this requirement need not apply to shaft alleys containing no assigned space for the stowage of combustibles. (46 CFR 118.310(d) & 46 CFR 76.10-10(d))

- Fire hydrants must be 1½ inch in size. (46 CFR 118.310(d) & 46 CFR Table 76.10-5(a))

- All parts of the fire main located on exposed decks shall either be protected against freezing or be fitted with cut-out valves and drain valves so that the entire exposed parts of such piping may be shut off and drained in freezing weather. Except when closed to prevent freezing, such valves shall be sealed open. (46 CFR 118.310(d) & 46 CFR 76.10-10(e))

Hose and Nozzles

- Fire station hydrant connections shall be brass, bronze, or other equivalent metal. (46 CFR 118.310(d) & 46 CFR 76.10-10(n)(1))

- Each firehose on each hydrant must have a combination solid stream and water spray fire hose nozzle that meets the requirements in 46 CFR 162.027. (46 CFR 118.310(d) & 46 CFR 76.10-10(j))

- Firehose nozzles previously approved under 46 CFR 162.027 may be retained so long as they are maintained in good condition to the satisfaction of the OCMI. (46 CFR 118.310(d) & 46 CFR 76.10-10(j))

- Straight stream firehose nozzles previously approved under 46 CFR 162.027 must have low-velocity water spray applicators. (46 CFR 118.310(d) & 46 CFR 76.10-10(k))

    1) Two firehoses within the accommodation and services areas; and

    2) Each fire hose in propulsion machinery spaces containing an oil-fired boiler, internal combustion machinery, or oil fuel unit on a vessel on an international voyage must have low-velocity water spray applicators of not more than 6 feet.

- Fire hydrants, nozzles, and other fittings shall have threads to accommodate the hose connections noted in 46 CFR 76.10-10(l). (46 CFR 118.310(d) & 46 CFR 76.10-10(m))

- Couplings shall either use 1 ½ inch and 2 ½ inch National Standard fire hose coupling threads (9 threads per inch for 1 ½ inch hose and 7.5 threads per inch for 2 ½ inch hose); or be a uniform design for each hose diameter throughout the vessel. (46 CFR 118.310(d) &46 CFR 76.10-10(n))

- Each section of fire hose must be lined commercial firehose that conforms to Underwriters' Laboratories, Inc. Standard 19 or Federal Specification ZZ-H-451E)). Fire hoses must be 50 ft in length. (46 CFR 118.310(d) & 46 CFR 76.10-10(n)(2))

Piping

- Piping materials shall be in accordance with 46 CFR 56.60, except that nonferrous metallic piping must meet 46 CFR 119.730. (46 CFR 119.710(c))

1) Ferrous piping used in salt water service should be galvanized or extra heavy schedule. (46 CFR 56.60-3(a))

2) If acceptable to the cognizant OCMI, nonferrous metallic piping with a melting temperature above 927 deg. C (1,700 deg. F) that are deemed to be galvanically compatible may be used in fire main systems. (46 CFR 119.730(a)(4))

3) Non-metallic piping, fittings and pressure containing components must be in accordance with IMO Resolution A.753(18) and IMO Resolution MSC.313(88). (46 CFR 119.720 & 46 CFR 56.60-25) Generally, this precludes the use non-metallic piping and pressure containing components (e.g. strainers with plastic or acrylic bowls)

- Provisions must be made to protect piping systems using aluminum alloys in high risk fire areas due to the low melting point of aluminum alloys. (46 CFR 119.730(b)(1)) (MSC recognizes fixed CO2 systems)

Additional Requirements for Subchapter K Vessels on an International Voyage

SOLAS

- Vessels on an international voyage must meet SOLAS requirements. See Attachment 2 located at the end of this document for assistance.

46 CFR Subchapter L

Vessels less than 100 GT and not more than 65' in length

Pumps

- Each vessel of less than 100 gross tons and not more than 65 feet in length may have, instead of a fire main that complies with 46 CFR Part 132, a hand-operated pump and a hose capable of providing an effective stream of water to each part of the vessel. (46 CFR 132.100(b))

- Each vessel **carrying flammable liquids or Noxious Liquid Substances in Bulk** must be equipped with at least one self-priming power-driven fire pump capable of delivering water to the TWO most remote hydrants through the hose and nozzle at a Pitot-tube pressure of at least 50 psi. (Reference (r))

Hoses

- A garden hose of nominal inside diameter of at least 16 millimeters (5/8 inch) may be used if it is:

  1) Of good commercial grade, constructed of an inner rubber tube, plies of braided-fabric reinforcement, and an outer cover made of rubber or equivalent fire-resistant material per; and,

  2) Fitted with a commercial garden-hose nozzle of high-grade bronze or equivalent metal capable of providing a solid stream and a spray pattern. (46 CFR 132.100(c))

Vessels 100 GT and larger and/or over 65' in length

Pumps

- Each vessel must be equipped with one self-priming power-driven fire pump capable of delivering a single stream of water from the highest hydrant, through the hose and nozzle at a Pitot-tube pressure of at least 50 psi. (46 CFR 132.120(a))

- Each vessel **carrying flammable liquids or Noxious Liquid Substances in Bulk** must be equipped with at least one self-priming power-driven fire

pump capable of delivering water to the TWO most remote hydrants through the hose and nozzle at a Pitot-tube pressure of at least 50 psi. (Reference (r))

1) The fire pump must be dedicated to the fire main system. A required bilge pump IS NOT acceptable as a fire pump.

- If two propulsion engines are installed, the fire pump may be driven by one of the engines. If only one propulsion engine is installed, the pump must be driven by a source of power independent of the engine. (46 CFR 132.120(d))

- No branch line may be directly connected to the fire main except for fighting fires or for washing the anchor or the deck. Each discharge line for any other purpose must be clearly marked and must lead from a discharge manifold near the fire pump. (46 CFR 132.120(g))

- When a fire monitor is connected to the fire main system, it must lead from a discharge manifold near the fire pump and be provided with a shutoff valve at the manifold and at the monitor. (46 CFR 132.120(h) & 132.330(a))

- If two fire pumps are installed, and if one pump remains available for service on the fire main at any time, the other pump may be used for other purposes; however, in no case may a pump connected to a line for flammable or combustible liquid be used as a fire pump. (46 CFR 132.120(e)&(j))

- Each fire pump must be capable of delivering a single stream of water from the highest hydrant, through the hose and nozzle at a Pitot-tube pressure of at least 50 psi while meeting any other demands placed on it, such as by a branch line connected to the fire main for washing the anchor or the deck. (46 CFR 132.120(f))

- The total cross-sectional area of piping leading from a fire pump may not be less than that of the pump-discharge outlet. (46 CFR 132.120(i))

- A fire pump must be capable of both manual operation at the pump and, if a remote operating station is fitted, operation at that station. (46 CFR 132.120(k))

- Each fire pump must be fitted on the discharge side with a pressure gauge and with relief valve set to relieve at either 25 psi in excess of the pressure necessary to maintain the pressure required by 46 CFR 132.120(a), or 125 psi, whichever is greater. The relief valve is optional if the pump is not capable of developing pressure exceeding the greater amount. (46 CFR 132.120(b)&(c))

Fire Main and Hydrants

- Each fire hydrant or "Y" branch must be equipped with a valve such that the fire hose may be removed while there is pressure on the fire main. (46 CFR 132.130(i))

- Each fire hydrant connection must be of brass, bronze, or equivalent metal. (46 CFR 132.130(j))

- Except for machinery spaces and shaft alleys, fire stations must be so numerous and so placed that each part of the vessel accessible to persons aboard while the vessel is being operated, and each cargo hold, are reachable by at least TWO effective spray patterns of water. At least two such patterns must come from SEPARATE hydrants and at least ONE must come from a SINGLE length of hose. (46 CFR 132.130(a))

- Each part of the main machinery space, including the shaft alley if it contains space assigned for the stowage of combustibles, must be reachable by at least TWO streams of water. EACH stream must come from a SINGLE length of hose, from a SEPARATE fire station. (46 CFR 132.130(b))

- Each outlet at a fire hydrant must be at least 1 ½ inch in diameter and, to minimize the possibility of kinking, must be fitted so that no hose leads upward from it. (46 CFR 132.130(e))

- Each station must be readily accessible. No deck cargo may interfere with access to fire stations; each pipe must run as far away from this cargo as practicable, to avoid risk of damage by the cargo. (46 CFR 132.130(h))

- Each part of the fire main on a weather deck must be either protected against freezing or fitted with cut-out valves and drain valves so that exposed parts of the piping may be shut off and drained in freezing weather. Except when closed against freezing, the cut-out valves must be sealed open. (46 CFR 132.130(d))

Hose and Nozzles

- Each hose on a fire station must have a fire nozzle approved under 46 CFR 162.027 that can discharge both solid stream and water spray. (46 CFR 132.130(g))

- The threads of fire hose couplings must be of brass or other suitable corrosion-resistant material and comply with NFPA 1963. (46 CFR 132.130(j))

- Each fire hydrant must have a fire hose 50 feet in length, with a minimum diameter of 1 ½ inches, connected to an outlet, for use at any time. (46 CFR 132.130(k))

- Each section of fire hose must be lined commercial fire hose, or lined fire hose that meets Standard 19 of Underwriters Laboratories, Inc. (UL). (46 CFR 132.130(n))

- Non-collapsible hose reel stations which are USCG Type Approved under Class 162.033 for fire main service are acceptable for the protection of open deck areas, columns, pontoons, and machinery spaces where there is sufficient room to unreel the hoses. (Reference (q))

- Each fire station must have at least one length of fire hose. (46 CFR 132.130(g))

Piping

- Piping must be hot-dip galvanized; at least extra-heavy schedule; or of a suitable corrosion-resistant material. (46 CFR 132.110)

- Except as provided for liftboats (noted below) by 46 CFR 134.180, each fitting, flange, valve, and run of piping must meet the applicable requirements of 46 CFR Part 128. (46 CFR 132.110)

Liftboats - Piping for fire-main suction 46 CFR 134.180

- Suction lines for fire pumps must comply with 46 CFR 132.110 except that suction lines extending below the main deck located outside of the hull plating that supply the fire pump when the liftboat is in the elevated mode must be metallic, unless they comply with the plastic pipe requirements of 46 CFR 56.60-25(c) for vital fresh-water and salt-water service, except that they may be of unlimited length. (46 CFR 134.180(b))

Additional Requirements for Subchapter L Vessels on an International Voyage

SOLAS

- Vessels on an international voyage must meet the requirements of SOLAS Chapter 2-II. See Attachment 2 for guidance.

46 CFR Subchapter T

Pumps

- Vessels must be fitted with fire single fire pump as noted below:

  1) A self-priming, power driven fire pump must be installed on each vessel <65 ft in length which is a ferry vessel. (46 CFR 181.300(a)(i))

  2) Vessel ≤ 65 ft in length and carrying ≤ 49 passengers may have fire buckets. (46 CFR 181.610)

  3) Ferry vessels ≤ 65 ft carrying ≤ 49 passengers must provide one self-priming, power driven pump rated at ≥10 gpm. The fire pump must be capable of projecting a hose stream from the highest hydrant, through the required hose and nozzle, a distance of 25 feet. (46 CFR 181.300(c))

  4) Vessels > 65' in length and vessels ≤ 65' carrying > 49 passengers must provide 1 self-priming, power driven pump rated ≥50 GPM and 60 psi minimum at the pump outlet. The fire pump outlet must be fitted with a pressure gauge (46 CFR 181.300(b))

- A fire pump must be permanently connected to the fire main and may be connected to the bilge system. (46 CFR 181.300(d))

- A fire pump must be capable of both remote operation from the operating station and local operations at the pump. (46 CFR 181.300(e))

Fire Main and Hydrants

- A fire hose with a nozzle must be attached to each fire hydrant at all times. (46 CFR 181.320(a))

- Each fire hydrant must have a valve installed to allow the fire hose to be removed while the fire main is under pressure. (46 CFR 181.310(c))

- A vessel that has a power driven fire pump must have a sufficient number of fire hydrants to reach any part of the vessel using a SINGLE length of fire hose. (46 CFR 181.310(a))

Hose and Nozzles

- Vessels > 65 feet in length and vessels ≤ 65 feet in length carrying > 49 passengers:

  1) The fire nozzle must be of a type approved in accordance with 46 CFR 162.027; or be of a type recognized by the Commandant as being equivalent in performance. (46 CFR 181.320(d)(1)&(2))

  2) Fire hoses fittings must be of brass or other suitable corrosion-resistant material that comply with National Fire Protection Association (NFPA) 1963 "Standard for Fire Hose Connections," or other standard specified by the Commandant. (46 CFR 181.320(b)(3))

  3) Fire hoses must be commercial lined conforming to Underwriters Laboratory (UL) 19 "Lined Fire Hose and Hose Assemblies," or be listed and labeled by an independent laboratory recognized by the Commandant as being equivalent in performance. (46 CFR 181.320(b)(1))

  4) Fire hoses must be 50 feet in length and 1.5 inches in diameter. (46 CFR 181.320(b)(2))

- Vessels ≤ 65 feet in length' carrying ≤ 49 passengers

  1) Fire hoses may be commercial lined as noted above, with fittings as noted above, or be a garden type hose of not less than 0.625 inches nominal inside diameter. (46 CFR 181.320(c)(1))

  2) All fittings on a garden type hose must be of suitable corrosion-resistant material. (46 CFR 181.320(c)(3))

  3) Each nozzle must be of corrosion-resistant material and be capable of being changed between a solid stream and a spray pattern. (46 CFR 181.320(d))

  4) Fire hoses must be of one piece not less than 25 feet and not more than 50 feet in length. (46 CFR 181.320(c)(2))

5) Garden type fire hoses must be of a good commercial grade constructed of an inner rubber tube, plies of braided fabric reinforcement, and an outer cover of rubber or equivalent material, and of sufficient strength to withstand the maximum pressure that can be produced by the fire pump. (46 CFR 181.320(c)(3))

Piping

- Piping, valves, and fittings in a fire main system must be composed of ferrous piping materials, except aluminum hulled vessels may have aluminum fire main piping so long as provisions are made to protect the piping in high risk fire areas due to the low melting point of aluminum alloys. (46 CFR 182.710 & 182.730)

  - Non-metallic piping materials and pressure containing components are prohibited in fire mains (vital piping system) unless noted in 46 CFR 182.720. Generally, this precludes the use of non-metallic piping and pressure containing components.

- If acceptable to the cognizant OCMI, nonferrous metallic piping with a melting temperature above 927 deg. C (1,700 deg. F) may be used in vital systems that are deemed to be galvanically compatible. (46 CFR 182.730(a)(4))

Attachments

Attachment 1: **FIRE PUMP LOCATION / SEPARATION OF SPACES**

Attachment 2: **SOLAS REVIEW GUIDE - FIRE MAIN**

Attachment 1

Fire Pump Location & Separation of Spaces

Pump Location

Most vessels are required to have two fire pumps with all suctions, sources of power, etc. located in separate spaces so that one casualty will not put all pumps out of operation. The alternative of installing both pumps in the same space and protecting the space with carbon dioxide is a deviation, permitted only in unusual circumstances where the separation of pumps will not increase safety - usually accepted for small vessels only. Such an arrangement is a poor substitute for separation of the pumps.

One important objection is that pumps are not required to be controlled from outside of the space. If a fire occurs in the space containing the pumps, the space will become untenable. Even upon discharge of CO2 and extinguishment of the fire, the spaces will remain untenable, delaying the availability of the pumps. There is a strong probability that when the pumps do become available, they will be inoperable.

As a basis for application of the requirement to separate fire pumps, a fire in one space is considered to be of such magnitude that the entire space, including the machinery space casing, is inaccessible and all equipment therein is made inoperable. When a pump powered by the emergency electrical system is to be used as one of the independent fire pumps, compliance with this requirement can be deceptive. Complete independence of fire pumps may be lost due to interdependence between electrical systems and boilers; runs of electric cable may be vulnerable to fire in several spaces, and non fire-proof boundaries of machinery spaces. Some examples of aspects which must be considered are:

(1) A steam fire pump in the boiler room in combination with an electric fire pump in the engine room supplied from the emergency electrical system may not comply with the regulation. If the boilers are dependent on electrically driven auxiliaries, a fire in the engine room may affect not only the electric fire pump, but also the normal electric supply to the boiler auxiliaries required for operation of the steam fire pump.

(2) An electric fire pump located remotely from the main machinery spaces and supplied from the emergency electrical system in combination with another fire pump in a main machinery space may not comply with the requirement. If the cable supplying the remote pump passes through either the boiler or engine room, a fire in that space will affect the machinery

Attachment 1 (Cont.)

space fire pump and may damage the power supply cable to the remote fire pump.

(3) An electric fire pump located outside the main machinery spaces and supplied from the emergency electrical system by a cable and motor starter attached to a machinery space boundary or casing may not be independent of the machinery space. In this situation it is possible for heat from a fire in the machinery space –to be conducted through the boundary or casing and damage the power supply to the fire pump.

(4) An electric pump is located outside of the main machinery spaces and is supplied from the emergency electrical system, the power for which is an independent diesel-driven generator. Location of the fuel supply to the independent diesel-driven generator in the machinery space or casing may nullify the fire pump separation. In this instance, a machinery space fire could disrupt fuel to the driver for emergency electrical power, thereby putting both fire pumps out of operation.

Separation of Spaces

One additional aspect which must be considered in the arrangement of fire pumps to comply with this requirement concerns "separation" of the spaces. For the purpose of determining compliance with this requirement, the following condition must be met in order for the spaces to be considered "separate":

(1) Any common boundaries between the spaces must be an effective "A" Class fire division.

(2) To insure that a fire in one pump space does not spread rapidly to an adjacent pump space, doors in common boundaries between the spaces shall be either:

i. Remotely operated Class II watertight doors, or
ii. Remote release, self-closing fire doors (installed alone or in tandem with dogged watertight doors); however, doors on the same level as and in close proximity to continuously manned control stations need not be of the self-closing type.

(3) The spaces shall have independent access. In the event that there is only a single engine space, it becomes increasingly difficult to find a suitable location for the second fire pump. There are three acceptable solutions to this problem of which the third is acceptable only in very unusual circumstances. Listed in general order of preference, they are:

i. Deep well pump - Installation of a deep well pump located in the accommodation and service space area above the machinery space would be acceptable. The suction shaft would pass down through the machinery space where it would take suction from a sea chest. All electrical components and valves would be located inside of the pump room, providing complete independence from the machinery space. Such an arrangement allows simple rapid operation of the system. Some of the problems which must be considered in such a design are:

(a) Provision for a flexible connection between the pump suction shaft and the pump to avoid undue stresses both at the connection and at the sea chest.
(b) Strength of the sea chest or suction shaft support.
(c) Insulation if the pump space immediately adjoins the machinery space.

ii. Forward pump - If a bow thruster is provided, the fire pump may be located in the forward portion of the ship with power provided by the bow thruster prime mover. Such an arrangement would possibly involve a considerable time delay before the pump could be actuated and remote control of the pump and valves from the accommodation area would be necessary.

iii. A separate enclosure - Building a small separate enclosure inside the machinery space with access from outside the machinery space has several drawbacks.

(a) To ensure that a fire in the engine space will not affect operation of the second fire pump, water supply, source of power, power cables, etc. should be independent of the machinery space.
(b) Despite all precautions the space may tend to become a "forgotten space," lacking maintenance, collecting debris, etc.
(c) Access to the space is difficult at best and could be a potential safety hazard due the long distance which must be traversed by a vertical ladder.
(d) There would likely be a considerable time delay before the pump could be started in the event of a fire in the machinery space.

Attachment 2

SOLAS REVIEW GUIDE

SOLAS: Chapter II-2, Regulation 10

Readily availability of water supply (Reg. 10/2.1.2)

- For passenger ships of 1,000 GT and upward, at least one jet of water must be immediately available from an interior hydrant; continued output of water must be by the automatic starting of one required fire pump. This requires the fire main to be continuously pressurized. A fire pump is acceptable for this purpose. If an alternate pump is used, its capacity should be adequate to supply one hoseline (80 gpm at 50 psi nozzle pressure)

- For passenger vessels of less than 1,000 GT, availability of water shall be through automatic starting of a fire pump OR remote starting of at least one fire pump from the bridge.

- For cargo vessels which have periodically unattended machinery spaces or where only one watch stander is required, the fire main must be either maintained under pressure or have remote starting capability of the main fire pumps from the navigation bridge and fire control station.

Fire main diameter (Reg 10/2.1.3)

- The diameter of the fire main shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously, except for cargo vessels the discharge need not exceed 140 m^3/hr (616 gpm)

    1) To determine minimum fire main diameter, use a reasonable discharge velocity (typically < 10 ft/sec) and standard hydraulic calculations (Q=VA).

Machinery space isolation valve (Reg 10/2.1.4)

- Isolation valves shall be provided to segregate the section of the fire main located within the machinery space containing the main fire pump from the rest of the fire main. The fire main shall be arranged such that when the isolating valves are shut all of the hydrants on the vessel, except those in the machinery space containing the main fire pump, can be supplied with

water by another fire pump or an emergency fire pump. The required valves shall be located in an accessible location outside of the machinery spaces.

- An emergency fire pump, its seawater inlet, and suction and delivery pipes and isolating valves shall be located outside the machinery space.

  1) Where this arrangement is not practicable, the pump sea chest may be in the machinery space if the suction valve is remotely controlled from the same compartment in which the emergency fire pump is located and the suction pipe is short as practicable.

  2) Short lengths of suction and discharge piping may penetrate the machinery space provided the pipe is enclosed in a steel casing or is insulated to "A-60" class standards and has a wall thickness not less than 11 mm (.433 inches) and be welded, except for the flanged connection to the sea inlet valve.

- For tankers, isolation valves shall be fitted in the fire main at the poop front in a protected position and on the tank deck at intervals not more than 40 meters.

Number and position of hydrants (Reg 10/2.1.5)

- Hydrants shall be such that at least two jets of water not from the same hydrant, one of which must be from a single length of hose, may reach any part of the vessel normally accessible to crew or passengers when the vessel is underway and any cargo space when empty, any ro-ro space or any vehicle space, in which latter case the two jets shall reach any part of the space, each from a single length of hose. Such hydrants shall be positioned near the accesses to the protected spaces.

- For passenger vessels, the hose requirement shall be met with all watertight doors in main vertical zones in the closed position.

- For passenger vessels, where access to a Category A machinery space is at a low level via a shaft tunnel, two hydrants shall be provided external to and near the machinery space entrance. Where access to a Category A machinery space is via other spaces and the spaces are part of an escape route, two hydrants shall be provided in one of the spaces at the machinery space entrance.

Required fire main pressure (Reg 10/2.1.6)

- With any two pumps operating simultaneously, the following minimum pressure must be maintained at all hydrants. The maximum pressure at any hydrant shall not exceed that at which the effective control of a fire hose can be demonstrated:

Vessel Type	Gross Tonnage	Minimum Pressure
Cargo ships	GT < 6000	36 psi (0.25 N/mm^2)
Cargo ships	GT ≥ 6000	39 psi (0.27 N/mm^2)
Passenger ships	GT < 4000	43 psi (0.30 N/mm^2)
Passenger ships	GT ≥ 4000	58 psi (0.40 N/mm^2)

International Shore Connection (Reg 10/2.1.7)

- Ships over 500 GT shall be provided with at least one international shore connection, complying with FSS Code, such that connection may be made on either side of the ship.

Fire pumps required (Reg 10/2.2)

- Sanitary, ballast, bilge or general service pumps are acceptable as fire pumps. Ships shall be provided with fire pumps as follows:

Vessel Type	Gross Tonnage	Pumps Req'd
Cargo ships	GT < 1000	2
Cargo ships	GT ≥ 1000	2
Passenger ships	GT < 4000	2
Passenger ships	GT ≥ 4000	3

Arrangements of fire pumps and fire mains (Reg 10/2.2.3)

- For passenger ships 1,000 GT and over, the pumps shall be arranged such that a fire in any one space would not put both fire pumps out of action.

- For passenger ships less than 1,000 GT and cargo ships, if a fire in any one space could put all fire pumps out of action, an emergency fire pump meeting the following requirements shall be provided.

1) The power source and sea connection for the emergency pump shall be outside the space containing the main fire pump and their power source.

2) The space containing the emergency pump shall not be contiguous to machinery spaces of Category A or spaces containing the main fire pumps. Where this is not practicable, the common bulkheads shall be insulated to standards required for a control station.

3) No direct access shall be allowed between the machinery space and space containing the emergency fire pump. Where not practicable, arrangements meeting SOLAS 10/2.2.3.2.2 may be accepted.

4) Ventilation for the space containing the emergency fire pump shall be such to prevent smoke from the machinery space from being drawn into that space.

Requirements for other pumps in the machinery space (Reg 10/2.2.3.3)

- For cargo vessels, where general service pumps, bilge pumps or ballast pumps are fitted in a machinery space, at least one of these pumps must be capable of delivering the required capacity and pressure of water to the fire main via a cross connection.

Total fire pump capacity (Reg 10/2.2.4.1)

- The TOTAL fire pump capacity is based on the bilge pump capacity required by SOLAS II-1, Regulation 35-1.

  1) For a passenger vessel, TOTAL fire pump capacity shall not be less than 2/3 required bilge pump capacity.

  2) For a cargo vessel, the TOTAL fire pump capacity, excluding an emergency fire pump, shall not be less than 4/3 required bilge pump capacity. The total fire pump capacity need not exceed 792 gpm (180 m^3/h)

Individual pump capacity (Reg 10/2.2.4.2)

- EACH fire pump capacity, other than an emergency pump, shall be at least 80% the total fire pump capacity above divided by the number of fire pumps required. In no case should an individual fire pump capacity be less

than 110 gpm (25 m^3/h). Each pump must be capable of delivery two jets of water at the required pressure.

Fire Hose and Nozzles (Reg 10/2.3)

- Generally, the hose and nozzle requirements are at the administration's discretion; hence we apply domestic requirements.
- In cargo ships of 1,000 GT and over, the number of hoses shall not be less than one hose per 30 meters of the ship plus one spare, but not less than five. This excludes the hoses required for an engine room or boiler room. For cargo ships less than 1,000 GT, a minimum of 3 hoses are required.
- Ships carrying dangerous cargoes shall be provided with an additional three hoses and nozzles.