

Changes shown by

SCOPE

- I 1.1 This practice covers the system design and installation of firewater systems.
- I 1.2 **An asterisk (*)** indicates that additional information is required. If a job is contracted, this additional information is furnished in the Job Specification.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 **AWWA Standard C502, Dry-Barrel Fire Hydrants for Ordinary Water Works Service**, shall be used with this practice.
- I 2.2 **The standard specified for use with this practice, and equipment descriptions** also given herein, apply to equipment and installation in the U.S.A. and in countries with no comparable standards. Where compliance with any code or standard by a local jurisdiction is mandatory, the requirements prescribed therein shall also be met.
- S * 2.3 **Fire hose couplings** selected for a particular plant location shall be **compatible with mutual aid and local fire protection facilities**. All fire protection equipment hydrants, monitors, hose reels, fire main block valves, etc., shall be consistent with other plant fire protection facilities and shall be approved by the plant Fire Chief.

SYSTEM DESIGN

DESIGN BASIS

- S * 3.1 **Design conditions**, water supply and rates, piping sizes, materials of construction, and type of hydrant couplings will be specified. The **firewater system design pressure and design temperature** shall not be less than the following:
 - a. **Underground**: 150 psig (1050 kPa) and 100°F (38°C).
 - b. **Aboveground**: 150 psig (1050 kPa) and 140°F (60°C).
- I * 3.2 **The system layout**, including the general location and number of pumps, hydrants, monitors, hose reels, deluge sprays, block and flushing valves will be specified. The final layout and location of equipment and facilities shall be approved by the Owner.
- S 3.3 **Connections for permanent use of firewater other than for fire protection** are not permitted, except for supply of water to flare seal drums.
- S * 3.4 **Underground carbon steel piping, and above-ground portions of carbon steel piping passing through a dike or dike sleeve**, shall be **protected against external corrosion** using a Single Coat-Single Wrap or Double Coat-Double Wrap protective coating system, as specified.
- S * 3.5 **Fire main materials shall be suitable for the plant firewater and designed** to reduce sediment buildup (by, for example, using cement lined pipe). The use of **reinforced plastic pipe (RTRP Grades)** for **firewater** systems requires approval of the Owner and the plant Fire Chief.

WATER SUPPLY

- S * 3.6 **When the firewater source can provide an unlimited supply of water** (for example, sea-water, lake-water, or river-water) and the system is designed to directly provide firewater to the grid, there are no requirements for firewater storage.
Where the firewater supply from a given source is limited:
 - a. **Firewater storage** shall be furnished, with a capacity equal to 6 hours supply at specified design flow rates, independent of other plant process water usage; **and**
 - b. **The firewater source** must be capable of **supplying water at one-half the specified maximum demand** on a continuous basis.
- S * 3.7 A **"break tank" (an atmospheric tank used to positively prevent contamination)** is required where firewater is supplied from a **potable water source, or any municipal source**.

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PUMPS AND DRIVERS

- S ♦ **3.8** A minimum of two firewater pumps, each sized for 50% of the system design capacity, are required. Design shall include the following:
- a. Each pump shall be designed for at least 125 psig (860 kPa) discharge pressure at rated capacity and good for continuous service. The pressure rise at shutoff should not exceed 20%, and at 150% of rated capacity the head shall not be less than 65% of rated head.
 - b. The system pressure shall be controlled at the pump discharge by a pressure controller, bypassing excess flow back to the source of supply.
 - * c. An averaging-type pitot tube installation shall be provided to permit testing the capacity of each firewater pump. The instrument shall be located in the bypass piping (pump discharge to source of supply), or, if specified, in the main firewater grid piping.
 - d. If the firewater pump shutoff pressure exceeds the firewater system design pressure, a pressure relief valve discharging to the firewater source shall be provided.
- S ♦ **3.9** Drivers:
- a. One firewater pump shall be electric motor driven.
 - b. Other pumps shall be steam turbine or diesel engine driven. If diesel engine driven, a fuel tank having a capacity of 6 hours of continuous operations at full load shall be provided.
 - c. A start-stop button for at least one main firewater pump shall be located in the main control house.
- S **3.10** Continuous positive pump suction shall be provided. Priming devices are not acceptable. Deep well pumps shall be used where positive pump suction is not available.
- S **3.11** Suction screens shall be provided where foreign material may be present that could plug the suction line or pumps. Either traveling or double removable screens, cleanable with the pump in service, shall be used.
- S ♦ ***3.12** The firewater system shall be continuously pressurized (when the main firewater pumps are not in use) by one of the following means, as specified:
- a. A separate, small, electric motor driven pressurizing pump manifolded in parallel with the main firewater pumps.
 - b. A "jumpover connection" from the plant cooling water or process water systems.
- A low pressure cut-in with alarm shall be provided to start one of the main firewater pumps at a specified pressure. The alarm shall be located in the main control house.

BOOSTER PUMPS

- S ♦ **3.13** Booster pumps (used to augment firewater system pressure for special fire protection systems such as spray systems, as required) shall take suction from the firewater system. Where the downstream pressure can build up to exceed the system design rating, a pressure relief valve discharging to a safe location, shall be provided.
- Conditions requiring booster pumps are:
- a. Extended firewater systems, where hydrant pressure may be insufficient to provide required flow.
 - b. Elevated structures within process unit areas where firewater system pressure may be insufficient to provide required flow.
- S ***3.14** Drivers for booster pumps will be either electric motors, steam turbines, or diesel engines as specified.

PIPING LAYOUT

- S ♦ ***3.15** The firewater system shall be looped around process units and other areas to be protected and the layout shall be approved by the Owner and the plant Fire Chief. Block valves shall be provided so that in the event of any piping failure:
- a. No more than 1000 ft (300 m) of pipe containing hydrants, hose reels, monitors or sprays can be lost.
 - b. The piping to not more than two adjacent sides of any process block can be lost.
- S ♦ ***3.16** Firewater mains in freezing climates (Climatic Zones B, C, and D) shall be installed a minimum of 1 ft (300 mm) below the frost line. Firewater connections to monitors, hose reels, sprays, etc., in freezing climates shall be winterized by design, (i.e., do not rely on procedures).

- S ♦ **3.17** **Firewater piping within process unit areas**, except for branches to hose reels and to elevated monitors, shall be **underground** and buried sufficiently deep to protect against mechanical damage. Any aboveground section within process units shall be minimized in length.
- S ♦ **3.18** **Firewater piping within process unit areas** feeding any combination of more than two monitors, hose reels, hydrants, or sprays, shall be **connected to two separate sections of the fire main** separated by a valve in the main. Lines to hose reels and monitors shall be valved at each end where they connect to the main. Branches to aboveground systems (elevated monitors, spray systems, etc.) shall be valved at the fire main and shall be capable of being opened and isolated from a safe location. However, short sections of above-ground pipe, less than 50 ft (15 m) long and not more than 2 in (50 mm) size, feeding a single hose reel, need not be valved at the firewater main takeoff.
- S * **3.19** **Firewater piping to marine terminals** shall be protected from direct exposure to a fire on the water by installing the lines above the pier deck. Where it is necessary to locate the lines below deck, they shall be fireproofed. In freezing climates (Zones B, C, and D) marine terminal firewater lines shall be heat traced and insulated. A minimum of four **valved hose connections (international hose connections)** shall be provided to permit **fireboats** to pump into the main firewater system, at a location to be specified by Owner.
- S * **3.20** As specified, the **firewater system** shall extend to **plant buildings** used for operations and storage.

HYDRANTS LOCATION AND SPACING

- S * **3.21** **Maximum hydrant spacing** shall be 300 ft (90 m) as measured along roadways or accessways between the hydrants in offsite areas and 150 ft (45 m) between hydrants in onsite areas. Other spacing may be specified by the Owner.
- S ♦ * **3.22** **Hydrants shall be located on the street or road side of all pipe lines or drainage ditches and shall not be located within diked areas for tanks.** The length of large diameter suction hose 4 in. (100 mm) size or larger, as defined by the plant Fire Chief, required between the hydrants and fire truck shall not exceed 25 ft (7.5 m). Where large pipe bands or drainage ditches may hinder access from hydrants to process areas or tank fields, hydrants shall be located near accessways or walkways across such obstructions.
- S ♦ * **3.23** **Additional area requirements governing the spacing and location of hydrants** are given below:

AREA	SPECIFIC REQUIREMENTS
Process Unit	Sufficient number of hydrants shall be provided around the periphery of the process unit to supply the design firewater capacity for the process unit through hose runs of not more than 100 ft (30 m). Hydrants shall be arranged such that only about one-half will be lost in case two sides of the loop around the process unit is damaged (and needs to be isolated). Valves and hydrants shall be so spaced that in the event of any line failure, flow shall be provided to two adjacent sides of a process unit at half the design capacity through hose runs not to exceed 400 ft (120 m) to reach all the equipment. Other spacing may be specified by the Owner.
Atmospheric Tank Storage:	
All tanks	Sufficient number of hydrants shall be provided around the storage tanks to supply the design firewater capacity for the tank in question. Valves and hydrants shall be located so that at least one hydrant is within 400 ft (120 m) of any tank in the event of a line failure. Other spacing may be specified by the Owner.
Where fixed air foam laterals are installed in any tank: Fixed Roof, Floating Roof, and Fixed Roof with Internal Floating Cover	Hydrants shall be located in relation to terminals of air foam laterals so that the total length of hose from hydrant to fire truck does not exceed 25 ft (7.5 m) and from fire truck to foam lateral does not exceed 50 ft (15 m).
Floating Roof tank	Hydrants shall be located such that the tank stairway is facing a hydrant.
Pressurized and Refrigerated Storage:	
All vessels	Hydrants shall be located on at least two sides of each vessel, so that the vessel can be reached by not less than 3 streams of water from hoses, each hose length not to exceed 300 ft (90 m).
Vessels arranged two rows deep	Hydrants shall be located along roads or accessways around the vessels.
Cooling Tower	At least two hydrants shall be located between 100 to 200 ft (30 to 60 m) of the cooling tower.

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MONITOR LOCATION

- S ♦ *** 3.24** **Monitors** shall be provided for fire protection of process units, and shall be **located** as follows:
- Monitor coverage shall extend to the complete process unit area and any other major hydrocarbon containing equipment. The monitor coverage shall be approved by the plant Fire Chief.
 - Monitors shall be located such that pipebands and other equipment shall not obstruct the firewater trajectory to the protected equipment.
 - Monitors may be elevated, as necessary, to achieve the required level of protection.
 - Where the monitor is at a **fixed location, at-grade**: Locate approximately 50 ft (15 m) from the equipment being protected. Where closer spacing is specified, the actuating valve shall be located at least 50 ft (15 m) from the protected equipment.
 - Where the monitor is at a **fixed location, elevated**: Locate approximately 50 ft (15 m) horizontally from equipment being protected, and at an elevation to cover said equipment. The actuating valve shall be located at grade below the monitor.
Where closer monitor spacing is specified, the actuating valve shall be located at least 50 ft (15 m) horizontally, from the protected equipment.
Where remote control of elevated monitors is specified, final designs shall be approved by the Owner.
 - Location of trailer mounted monitors** will be specified.
- S **3.25** **Cooling towers constructed of combustible materials** shall be protected by **fixed location, at-grade, monitors**, in sufficient number to provide firewater coverage to all sides.
- S ♦ **3.26** **Pressurized (horizontal) storage vessels handling flammable materials** shall be **protected** as follows:
- If **three or more vessels** are installed in the same area, **each** shall be **fireproofed**.
 - * If **one or two vessels** are installed in the same area, provisions for **cooling with water may be substituted for fireproofing**. The water for protecting the **areas of the vessels containing nozzles or valves**, and those areas within 10 ft (3 m) of any valve in the piping shall be provided by **fixed monitors**. Other areas of the vessel may be protected by hydrant hoses. Use of fixed firewater spray systems instead of monitors shall be approved by the plant Fire Chief.
 - Fixed firewater monitors shall be provided on at least two sides of **each sphere or spheroid** so that the entire underside of the vessel can be reached from the monitors.

HOSE REEL LOCATION

- S ♦ *** 3.27** **Hose reels shall be located** per the following:
- Within process unit areas**: **Hose reels shall not be the primary means of fire protection in process units**. The minimum number of hose reels in a process unit shall be two, located in opposite sides of the unit. Additional hose reels shall be based on providing coverage to the entire plot area with spacing at approximately 200 ft (60 m) centers.
 - Outside process unit areas**: Hose reels as required to protect equipment and facilities likely to be a source of hydrocarbon release, such as at pump areas, at tank car or tank truck loading stations, and similar fire risk areas.
 - On cooling towers constructed of combustible materials**, sufficient hose reels are required on the fan deck to provide total deck area coverage unless specified differently by the Owner.

HYDRANT SELECTION AND INSTALLATION

- S *** 4.1** **Self-draining hydrants** shall be used in **freezing climates** (Climatic Zones B, C, and D). Hydrants with self-draining feature shall not be used on aboveground fire line installations.
- S ♦ *** 4.2** **Hydrant connections**. Hydrants shall be capable of delivering a nominal 1000 gpm (227 m³/h) at 80 psig (550 kPa) grid pressure. Each hydrant shall be provided with three valved and capped connections for 2-1/2 in. (65 mm) size hose and one pumper connection for 4 in. (100 mm) minimum size hose, or larger, as defined by the plant Fire Chief. Threaded pumper connections shall be fitted with a pressure-tight cap suitable for the system design pressure. Quick coupling pumper connections shall be valved. All caps shall be secured to the hydrant with chains.