Property Risk Consulting Guidelines

A Publication of AXA XL Risk Consulting

PRC.14.5.0.1

PRIVATE FIRE MAINS

INTRODUCTION

National Fire Protection Association (NFPA) documents describe a level of fire protection agreed on by persons representing a variety of interests. The guidance in these documents does not reflect unique conditions or special considerations, such as system performance under adverse or unusual conditions. Nor does NFPA guidance reflect the increased system reliability that AXA XL Risk Consulting recommends for high valued properties.

This PRC Guideline states AXA XL Risk Consulting's position on selected provisions of NFPA 24 because AXA XL Risk Consulting believes they require clarification or changes. To understand AXA XL Risk Consulting position, this PRC Guideline must be read with a copy of NFPA 24. The provisions of the NFPA document are not repeated.

POSITION

General

Because of contamination concerns, many municipalities now require the use of backflow preventers in public water connections to private fire protection mains. Where such devices are required, they must be listed by a recognized testing laboratory and sized in accordance with the manufacturer's maximum recommended flow rate.

AXA XL Risk Consulting does not recommend combined domestic/fire protection underground systems. A separate fire protection underground system is more reliable than a combined system because of the following:

- High pressures necessary for fire fighting could damage domestic piping and equipment.
- Continuous flow will increase tuberculation in unlined ferrous pipes.
- System pressure cannot effectively be controlled and supervised, i.e., it is difficult to arrange the prompt automatic starting of fire pumps.
- Process use during a fire emergency could reduce the flow available for fire protection equipment.
- The potential for impairments is increased since more personnel have access to the system.

Connection to Waterworks Systems

Sources supplying fire protection mains should be reliable and adequate to supply the anticipated fire protection demands. For information on the acceptability of water supplies, refer to PRC.14.0.1.

Waterflow Test Data

The installing contractor is responsible for the accuracy of the flow test used to justify the hydraulic design. Use only recent data from a test located near the system being deigned. Adjust the test results to the base of the sprinklers riser or connection of the sprinkler lead-in to the underground so that the sprinkler system requirements can be compared without additional calculations.

Flow test results are to include an indication of the location where the test was conducted, the static pressure, residual pressure, flow rate and time of test. The time of day and season of the year play an important part in the results of a public water test. To avoid inflated results, adjust the water test data to reflect the lowest static and residual pressure experienced in the area. If tests over a number of years indicate a definite trend of deterioration, predicate the acceptance of the city water supply upon the completion of the recommendations designed to halt and preferably reverse this trend.

Example:

Hydrant tests indicate a static pressure of 85 psi (5.9 bar) and a residual pressure of 70 psi (4.8 bar). Previous records indicate that, at the same flow, a static pressure of 75 psi (5.2 bar) and a residual of 60 psi (4.1 bar) are normal. Thus, reduce the latest water supply curve by 10 psi (0.7 bar) to reflect the fluctuating water supply conditions in the area.

Size Of Fire Mains

When sizing private fire protection distribution systems, AXA XL Risk Consulting recommends the following:

- Size mains to take full advantage of the water supplies available. Large water supplies are wasted if the water distribution system cannot or only marginally delivers the water to the desired area.
- Size looped systems to meet the demand with one leg of the loop out of service.
- Use 6 in. (150 mm) mains to supply individual sprinkler system risers or one or two fire hydrants.
- Use 8 in. (200 mm) mains to supply two or more sprinkler systems or to feed three or four fire hydrants.
- Limit the use of 8 in. (200 mm) mains for general distribution to small facilities and areas of larger facilities containing light hazard occupancies where the water demands will not exceed 1000 gpm (3785 L/min).
- Use 10 in. (250 mm) mains in industrial facilities of moderate hazards (Ordinary Hazard Group 1 or 2 Occupancies as defined in NFPA 13).
- Use 12 in. (300 mm) and larger mains should be used where the water demands are high (over 2000 gpm (7570 L/min)), or the facility is large and water must be transported over significant distances.

Looped fire mains are desirable since they allow water to reach the needed area from two directions, thereby improving the reliability of the system. If impairment occurs in the distribution piping, water can be supplied from an alternate direction.

Looped fire protection mains should be recommended:

- Around important buildings or structures.
- Around buildings or structures with severe occupancy hazards.
- When dead-end sections would exceed 1500 ft – 2000 ft (457 m – 610 m) in length, except when supplying a single remote building or area.

Private fire mains distribute water from a supply source to fire protection equipment. The mains must be sized to deliver the water at the flow and pressures required by the fire protection systems. Consider future requirements if the distribution system is to remain adequate after an expansion or occupancy change. The sizing of mains also requires consideration of the building construction, occupancy hazards and main layout (loops vs. dead-end feed) at a facility.

The importance of proper main sizing can be illustrated by comparing the friction loss in various pipe sizes often used. Assuming a hazard requires 1500 gpm (5680 L/min) and is located 1000 ft (305 m) from the water supply source, the friction loss in 1000 ft (305 m) of 15 year old (C = 100) iron pipe is shown in Table 1.

TABLE 1
Friction Loss in 1000 ft (305 m) of 15 year old (C = 100) iron pipe

Pipe Diameter	Friction Loss
6 in.	110.0 psi
8 in.	27.0 psi
10 in.	9.5 psi
12 in.	3.8 psi
14 in.	1.8 psi

SI Units: 1 in. = 25.4 mm, 1 psi = 0.07 bar

The friction loss in the 6 in. and 8 in. (150 mm and 200 mm) pipe sizes would be unacceptable for most water supplies.

Pressure-Regulating Devices and Meters

Use UL listed (HDRT). Fire flow meters designed for minimal friction loss in fire protection mains.

Do not use pressure regulating valves on supply connections. However, pressure regulating valves may be accepted where the public water supply pressure exceeds 150 psi (10.4 bar), or where the local authority requires them.

Where pressure regulating valves are installed, the following is recommended:

- The valve should be of the pilot-operated fixed pressure type.
- Provide a bypass around the pressure reducing valve.
- Provide a pressure relief valve on private fire mains to protect equipment from excessive pressure. Locate the valve above grade or where adequate drainage can be provided.
- Provide a means to test the operation of the pressure reducing valve. Provide a 2 in. (50 mm) drain pipe or 2!/2 in. (65 mm) hose connection to drain the test water. Test the valve monthly.
- Flush the supply piping should be thoroughly to installation. When the valve is installed on a dead end main or a raw water supply, strainers may be necessary to prevent plugging of the pilot operator.
- Install meters and check valves downstream of the pressure reducing valve.

Pressure reducing valves are commonly installed on municipal water systems. In this application, the valves are exercised frequently and have proved to be reliable. When installed on fire protection mains, the valves are not routinely exercised and can become sluggish in operation. In addition, under little or no flow conditions it is possible for the pressure downstream of the valve to creep up to the supply pressure.

Care must be used when selecting the size of a pressure reducing valve. Most valves have a minimum and maximum recommended flow rate. When operating near the minimum rate, these valves are almost closed and prolonged operation near this minimum flow rate should be avoided to prevent damage to the valve due to chatter. When such conditions are likely to be encountered, two valves each designed for a specific flow range should be installed in parallel.

The reduced pressure type of backflow preventer, while an improvement over other types, has a greater friction loss than double check valves. This increased pressure loss must be considered when evaluating public water supplies or sizing booster pumps. A backflow preventer, when installed in conjunction with a booster pump, should be located on the **DISCHARGE SIDE** of the pump, and the pressure rating of the pump increased to compensate for the friction loss of the backflow preventer.

Pumps

A single automatically controlled fire pump taking suction from a tank is not normally considered an adequate water supply source if it constitutes the sole water supply.

Where a fire pump has been determined as adequate as the sole supply for hydraulically designed sprinkler systems, review the hydraulic calculations to verify that the sprinkler and hose stream demands will be met simultaneously. See PRC.14.0.1 for additional discussion on acceptable water supplies.

Tanks

Acceptability of a gravity tank as a sole source requires the tank be capable of being refilled in less than 8 hrs.

Pressure tanks are generally unacceptable as water supplies because of their limited volume. For light or ordinary hazard Group 1 occupancies, however, they may be used in conjunction with a single fire pump and suction source to create an acceptable initial water supply and to ensure that sprinkler system waterflow alarms operate. See PRC.14.0.1 for additional discussion on acceptable water supplies.

Fire Department Connections

Provide a fire department connection to allow the fire department to pump water into the private fire protection system. A single fire department connection supplying the entire fire protection system is the preferred arrangement for small and moderate sized systems. This requires the fire department connection discharge into the system side of all water supply control valves and the supply side of all sprinkler, hydrant and standpipe connections. Provide a public hydrant with pumper connection within 40 ft – 50 ft (12 m – 15 m) of the fire department connection.

Several connections are desirable in a large industrial or commercial complex. Arrange each connection to supply the entire fire protection system, and be installed at a public water supply connection to eliminate any confusion.

Multiple fire department connections each supplying portions of the fire protection system, i.e., a single sprinkler riser, are **NOT DESIRABLE**. Experience has shown this can cause confusion resulting in improper action by a fire department during a loss. Problems that have occurred include the following:

- The fire department discharges into the wrong fire department connection. This can be due to poor labeling of the fire department connection or uncertainty concerning the exact area of the fire or the area protected by a specific sprinkler system.
- The operation of multiple sprinkler systems requires the fire department to discharge into several connections, tying up equipment and manpower.
- The fire department decides not to use the siamese connections.
- The connection does not remain accessible when located in a nonrated building wall.
- Access to the individual connections is limited because of fences, parking lots or landscaping.
- Individual connections may be remote from an adequate suction source and require extensive hose layouts.

Types of Valves

Post indicator valves are preferred as they are easy to locate and remain accessible under all but the most unusual of conditions.

Restrict the use of curb box type nonindicating valves to hydrant control only due to the following:

- Curb box valves can be difficult to locate. They are often covered over by dirt, ice, snow or paving materials.
- Care is needed to prevent dirt and water from entering the cover and preventing valve operation. During the winter months any water in the valve box may freeze.
- “T” wrenches are often misplaced, and valve covers can be difficult to remove. This results in a delay in valve operation during an emergency.
- Curb box valves are difficult to supervise.

When curb box valves must be used, AXA XL Risk Consulting recommends the following:

- Provide a “T” wrench for each valve and locate it nearby, i.e., on an adjacent building wall or in a marked cabinet.
- Provide a sign should be provided clearly indicating the location of the valve in the road, e.g., 10 ft (3 m) north of building wall.

Post Indicator Valve Location

Control valves should always be accessible. A 40 ft (12 m) separation from a building wall usually ensures the valve will not be unduly exposed by radiant heat, and will also remain accessible should a building wall collapse. When the distance is reduced, the exposure to the valve must be evaluated to determine if additional precautions should be taken to maintain valve accessibility. Do not use wall post indicator valves unless wall collapse is unlikely. A blank non-load bearing masonry wall exposed by a Light or Ordinary Hazard Group 1 or 2 Occupancy would not be expected to fail catastrophically. One exception to this would be when there is little space between the property line and the building wall, thus requiring a choice between outside accessibility and the less desirable alternative of an OS&Y control valve on the riser inside the building.

Valves in Pits

Provide access to control valves. It is common practice to locate public water supply control valves and other valves in frostproof pits with access provided through a manhole. Valve pits are subject to atmosphere contamination from many sources. They also may contain an oxygen deficient atmosphere. As a result, valve pits are “confined spaces,” as defined by the Occupational Safety and Health Administration (OSHA), and valves located within them will not always be accessible.

The mere fact that valve pits are confined spaces will prevent prompt shutting (or opening) of valves located in pits during an emergency due to the safety precautions that must be followed before the pit can be entered. Provide control valves located in pits with valve extensions and an indicator post. Other means to allow operation of the valve without entering the pit may be acceptable when a permanent indicator post cannot be installed. Design new installations to avoid the use of valves in pits.

Consider installing check valves, meters and backflow preventers above grade in suitably designed enclosures. If these are installed in pits, establish maintenance procedures that include proper, safe confined space entry procedures.

Sectional Valves

Sectional control valves are necessary to limit the amount of protection out of service with a main break, or when repairs or extensions are made to the system. Provide sectional control valves as follows:

- On each side of all supply connections.
- Within main sections so the number of fire protection units (sprinkler system, hydrant or other connection) located between sectional control valves does not exceed five.
- On each side of a river, canal, building or railroad tracks that fire protection mains pass under or through. It is AXA XL Risk Consulting’s normal recommendation to abandon mains in the way of building additions and to replace with mains that are clear of the proposed expansion.

- At the intersection of major loop sections.

Identifying and Securing Valves

AXA XL Risk Consulting prefers electronic supervision of all fire protection control valves 2½ in. (65mm) and larger. The signals should be sent to a constantly attended location. In addition to electronic supervision, the valves should be visually inspected weekly to assure they are fully open.

Hydrants

Hydrants should be of the base valve (dry barrel) design. Wet barrel designs are not recommended for new systems within the continental United States, parts of Europe, and parts of Asia since freezing temperatures are expected throughout these areas. In recent years, freezing temperatures have occurred in southern California and other areas where cold temperatures are not normally considered a problem. Wet barrel hydrants are acceptable only where existing hydrants are of the wet barrel design and there is NO potential for freezing.

AXA XL Risk Consulting recommends private hydrants be provided with two or three 2½ in. (65mm) outlets. Pumper outlets should not be provided except when used to allow emergency cross connections between two normally separate water systems, or in chemical, oil, and other properties where the outlet will be used to supply a hydrant mounted monitor nozzle, or facility pumper truck, thus leaving the 2½ in. (65 mm) outlets available for hose lines. Gate valves should be provided on each 2½ in. (65mm) outlet.

For many years, AXA XL Property Risk Consulting and its predecessors have recommended that yard hydrants (as opposed to public hydrants) not be equipped with a pumper suction outlet (sometimes called a steamer connection). These are most commonly 4½ in. (115 mm) outlets but may be larger or smaller. Where they did exist; the recommendation was to disable them so that they could not be used. This style hydrant is most common in North America.

The primary reason is because of the potential to “rob” water from the sprinkler system. Such large outlets can easily provide well over 1000 gpm (3800 l/min) to fire department pumpers, which in turn diverts critical water away from the sprinklers. This has resulted in the loss of sprinkler control.

Other reasons include the possibility of “out pumping” a facility fire pump that is feeding the hydrant and damaging the facility pump, increased opportunity to create a water hammer, an providing unexpectedly high pressure to the fire department pumper.

When sprinklers are operating properly, there is generally no need for the quantity of water that a pumper outlet can deliver. The anticipated hose stream demand can easily be provided through one or two standard yard hydrants without the pumper connection.

There are times; however, when large pumper outlets can be beneficial. Examples are yard storage fires and situations where the sprinkler system was rendered ineffective by a collapse or explosion.

NFPA 13E *Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems* outlines proper procedures for fire department operations at sprinklered buildings. Fire departments should be well versed in this document and use it as the basis for a site-specific pre emergency plan. AXA XL Risk Consulting also offers site-specific training and this training is highly encouraged.

Where the local fire service fully understands when pumper outlets should and should not be used, they may remain in service and new hydrants can have pumper outlets. If there is any doubt about the fire service’s understanding of the appropriate use of these outlets, they should receive appropriate training.

Hydrants – Outlet Threads

Hydrant outlet threads should be compatible with those of the local fire department. If the threads are not compatible, suitable adapters should be provided, and a supply maintained at the facility and at the local fire department.

About 75% of the United States uses type “NH” (also known as “NST” or “NS”) hose threads as recommended in NFPA 1963. However, some areas developed standards before the adoption of a national standard, and the local standard is still used. Problems are encountered when mutual aid is needed and a nearby fire department uses a different type of hose thread. While the best arrangement is to provide compatible threads, where the local hose thread differs from type “NH” adapters converting the local thread to type “NH” should be provided. This will usually allow compatibility.

Hydrants – Number and Location

Hydrants on private fire mains should be spaced at approximately 250 ft (76 m) intervals, and building access doors provided at intervals, which allow all protected areas to be reached with a minimum of hose. Where there is yard storage or congestion that would limit access to an area of the facility, additional hydrants may be needed. Hydrants located in facilities with hazardous occupancies, such as oil, chemical, or petrochemical properties or where the clearance from buildings is less than 40 ft (12 m), may also require reduced spacing. Where mains extend to remote areas of a facility, hydrant spacing may be increased to 300 ft (90 m).

For buildings with severe occupancy hazards, e.g., high piled storage, flammable liquid processing or explosion hazard, this 40 ft (12 m) separation may need to be increased.

Wall hydrants are **NOT RECOMMENDED**. They are vulnerable to impairments resulting from wall collapse and explosion damage. Wall hydrants should only be accepted when:

- Physical arrangements, e.g., rock ledge, canals or railroad sidings, make the installation of a regular hydrant impractical.
- Proposed early expansion in the area results in the use of a wall hydrant as a temporary substitute for regular hydrants that will be installed as part of a continuing expansion program.
- They are planned only for outside exposure protection.

When installed, wall hydrants should be supplied independent of sprinkler systems and provided with a separate control valve. (Refer to Figures 1A and 1B.)

Roof hydrants provided in risks having large areas under a single roof where hose access from yard hydrants is limited are beyond the scope of NFPA 24. Roof hydrants should be designed and engineered considering the hazards of the facility.

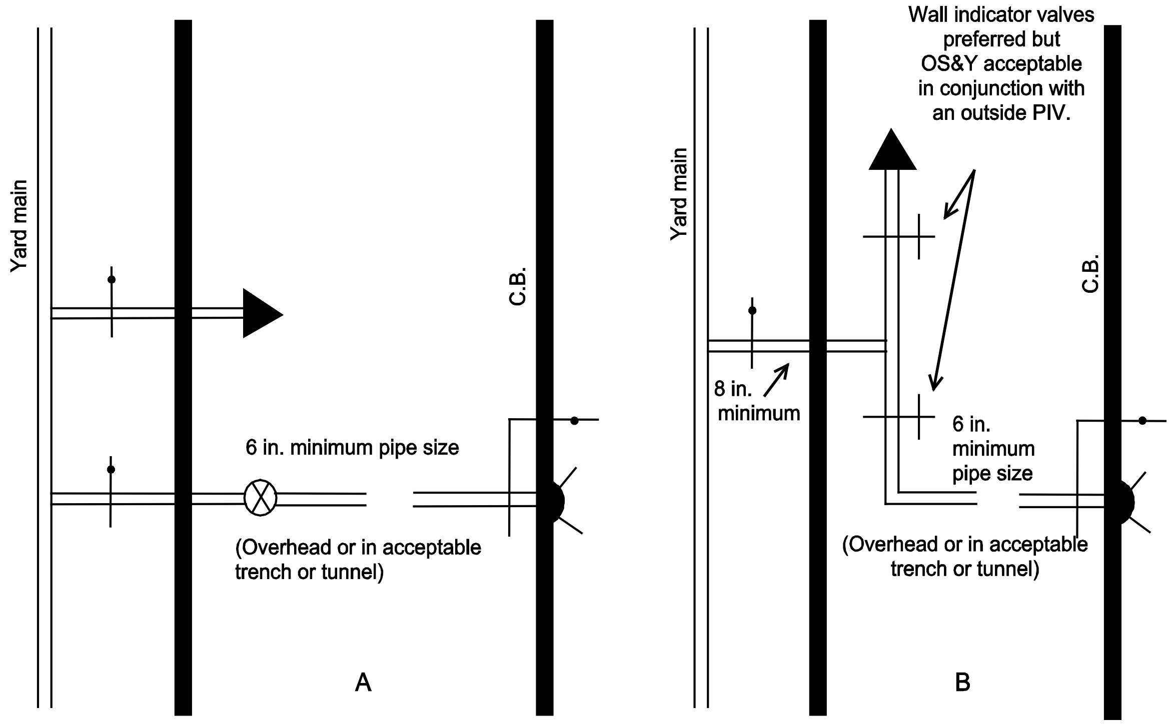

Figure 1. Wall Hydrant Arrangements.

Hose Houses and Equipment

All facilities should maintain a sufficient length of 2½ in. (65mm) woven-jacketed lined hose and accessories to allow the following:

- The provision of emergency water supplies to impaired sprinkler systems through the 2 in. (50 mm) drain connection supplied by a hydrant, adjacent sprinkler system or domestic water supply. (Refer to OVERVIEW and PRC.1.1.0.)
- Testing of fire pumps.

A supply of listed, woven-jacketed lined hose and equipment should be provided for use by the facility's Interior Structural Fire Brigade when any of the following conditions exist:

- There is no public fire department coverage in the area.
- The facility is located more than five miles from the first responding fire department.
- The hazards of the facility are such that the fire department cannot respond fast enough to halt the spread of fire.
- The facility relies heavily on manual fire suppression.
- The fire department is poorly equipped to handle the special hazards of the facility.

The amount of hose necessary depends on the hydrant layout, facility hazards and manpower availability. Provide enough hose to reach all interior building areas with at least two hose lines.

Some facilities use small motorized hose carts to store and deliver hose to the hydrants. Each cart should be equipped with a combination of 1½ in. and 2½ in. (40 mm and 65 mm) hose totaling 400 ft – 500 ft (122 m – 152 m) and associated equipment. The number and location of the hose carts should be arranged so the hose can be delivered to the necessary hydrant in conjunction with the fire brigade arrival. Several carts, stored at strategic locations, are usually required.

Some large industrial facilities and many oil, chemical and petrochemical facilities have one or more fire trucks. Trucks equipped with a hose bed should carry 1000 ft (305 m) of 2½ in. (65 mm) fire hose and 400 ft (122 m) of 1½ in. (40 mm) hose. Recommendations for equipment to be carried on trucks are presented in NFPA 1901.

In areas inaccessible to motorized apparatus and in facilities without vehicles to carry hose, hose houses equipped with a minimum of 250 ft (76 m) of 2½ in. (65 mm) hose and 150 ft (45 m) of 1½ in. (40 mm) hose and associated equipment should be provided.

Public fire departments may be unfamiliar with the type and condition of equipment and hose provided in a specific facility, and many will not use it. It is not necessary to supply equipment solely for use by the public fire department.

Experience has shown that fire hose and equipment will not be used by facility personnel unless they are well trained in its use. Members of an incipient stage fire brigade will not be trained in the use of 2½ in. (65 mm) fire hose, and may not use 1½ in. (40 mm) hose on incipient yard fires unless it is preconnected. Interior structural fire brigade members will be trained to use yard hydrants, 2½ in. (65 mm) hose, and related equipment. Refer to *OVERVIEW* and NFPA 600 for further details.

Hose should have woven jackets and be lined. Unlined hose should not be used. When hose is subjected to corrosive environments or materials, suitable covers should be provided.

Master Streams

Master streams or monitor nozzles are an aid to manual fire fighting. Their primary advantages are that they can be placed into service quickly by a single operator and once set can continue operating without attention. They can also be arranged for remote operation. Monitor nozzles are most often found in oil, chemical, and petrochemical properties, airplane hangars, and heliports but can be valuable protection for the yard storage of flammable or combustible materials.

Application and Special Considerations

The sizing and location of monitor nozzles depends on the size and hazard of the area being protected and the available water supplies. Monitor nozzles come in sizes ranging from 250 gpm to 2000 gpm (945 L/min to 7570 L/min) and larger. When selecting a monitor nozzle, the water supply available, the configuration of the area being protected, and the discharge characteristics of the nozzles being considered must be taken into account. To be effective, monitors must be supplied with at least 80 psi (5.5 bar) residual pressure at the design flow rate.

Monitor nozzles protecting outside hazards should be located so all areas can be reached by at least two streams. The reach of a monitor stream varies with the pressure available and the type of streams (¼ fog, ½ fog, straight). A reach of 75 ft – 100 ft (23 m – 30 m) can be used for spacing monitors when specific information is not available. When a structure is protected by automatic sprinklers in addition to monitor nozzles, the units should be spaced around the perimeter of the hazard and arranged so all areas can be reached by at least one stream. Where necessary to provide adequate coverage, elevated, remote actuated and oscillating monitors should be provided. Refer to PRC.17.2.1 and PRC.17.3.1 for additional guidance in oil and chemical properties.

Underground Piping

An important feature of the UL listing or FM approval is that each length of pipe is hydrostatistically tested.

Pipe Type and Class

When selecting the proper pipe for an installation, the size of pipe, working pressure, laying condition and depth of cover must be considered.

Select ductile iron pipe in accordance with the applicable ANSI standard. Usually, the depth of bury has a greater effect on the thickness class than does the working pressure. Ductile iron pipe with a thickness Class of 50 will be acceptable providing the depth of bury does not exceed 15 ft (4.5 m), the pipe size does not exceed 20 in. (500 mm) and the working pressure is less than 350 psi (24 bar).

Select plastic, cement asbestos and reinforced concrete pipe in accordance with its listing and installed in accordance with the manufacturer's instructions and NFPA 24.

Transition plastic pipe to ductile iron pipe prior to entering the footprint of the building.

Lining of Buried Pipe

Use only lined ductile iron pipe in accordance with ANSI/AWWA C104/A21.4-90. All cast iron, ductile iron or steel, underground fire main components are to have polyethylene encasement in accordance with ANSI/AWWA C105/A21.5 , unless a soil test demonstrates the area where the underground will be installed has a CIPRA score less than 10. The "10 Point" CIPRA soil test evaluation procedure assigns from one to ten points for the results of each of five areas of soil characteristics which contribute to corrosivity. These are Resistivity (ohm/cm), pH, Redox potential, Sulfides, and Moisture content. The point score in each area is summed to arrive at a CIPRA score. A score of 10 or more is regarded as corrosive to ductile iron pipe. Protection can also be achieved by suitable coating of the pipe; however, care is needed to prevent damage to the pipe coating during handling and installation. Cathodic protection can be used to prevent corrosion, but the systems are costly and require high maintenance.

Where external corrosion is anticipated, polyvinyl chloride, fiberglass reinforced epoxy resin, or reinforced concrete pipe may offer improved corrosion resistance.

Certain organic solvents, such as ketones and aromatic hydrocarbons, will affect polyvinyl chloride. The long term effects of other hydrocarbons are not known. Until test data is available for specific solvents, plastic piping, including the necessary gaskets, should not be used in soil that is or may become saturated with these materials. Give similar consideration to locations where the water supply is or may be contaminated by these solvents, e.g., a chemical plant where the fire pump suction supply is from a cooling tower basin.

Pipe Joint Assembly and Restraint

Best practice suggests bolts used for underground pipe to be of a material known as core-10 and coated with nylon or Teflon, but standard bolts coated with nylon or Teflon are acceptable.

Ductile iron, cement asbestos and reinforced concrete pipe all have a rough surface allowing the soil to hold it in place. Plastic pipe has a smooth surface and may require additional restraint.

When sizing thrust blocks, use 1000 lb/ft^2 (4882 kg/m^2) for maximum lateral bearing strength of soil. Calculate the thrust pressure at 50 psi (3.4 bar) above the hydrostatic pressure with a minimum of 250 psi (17 bar) thrust pressure. Higher thrust pressures maybe required if pipe is subject to large water hammers or has a history of blowouts. If the ground contains soluble sulfates, use a sulfate resistant concrete.

Restrained Joint Systems

Use conventional tie rods, pipe clamps, restrained mechanical joints and thrust blocks should be used to anchor sprinkler risers to underground piping rather than other "approved devices," such as mechanical retainer glands with setscrews.

Because of the location of sprinkler riser piping in relation to building foundations and floors, **avoid the use of mechanical retainer glands in or near buildings and fire pump houses**. They may be used inside fire pump houses if the setscrews have the "break-away" type heads to assure application of the necessary torque.

When mechanical retainer glands are used to anchor other components of the underground system, strictly adhere to the following requirements:

- Torque wrenches must be used for tightening setscrews in accordance with the manufacturer's installation instructions.

- The specific location of each retainer gland should be clearly indicated on the contractor's drawing so it can be determined that sufficient glands are being used, and they are properly located.
- Where unstable soil conditions are involved, a second method of anchorage in addition to the mechanical retainer gland.
- Mechanical retainer glands shall not be used where the soil is suspected to be corrosive.

Several types of retainer glands (couplings) are suitable for underground use only. Do not use them for aboveground unless specifically listed for aboveground use and provided with setscrews having breakaway heads to assure the application of the needed torque.

In the past, the use of mechanical joint retainer glands has been accepted in lieu of conventional tie rods, clamps and concrete blocking to anchor tees, plugs, caps, bends and hydrants. However, there have been several losses where pipe separation has occurred because of the contractor's failure to properly tighten setscrews to the specified torque as recommended by the manufacturer's installation instructions and required by the UL listing; the use of torque wrenches is required.

Size of Aboveground and Buried Pipe - Private Service Mains

The minimum underground pipe size should be 4 in. (100 mm) when proven by hydraulic calculation to be adequate to supply the anticipated sprinkler and hose demands. Otherwise the minimum size should be 6 in. (150 mm).