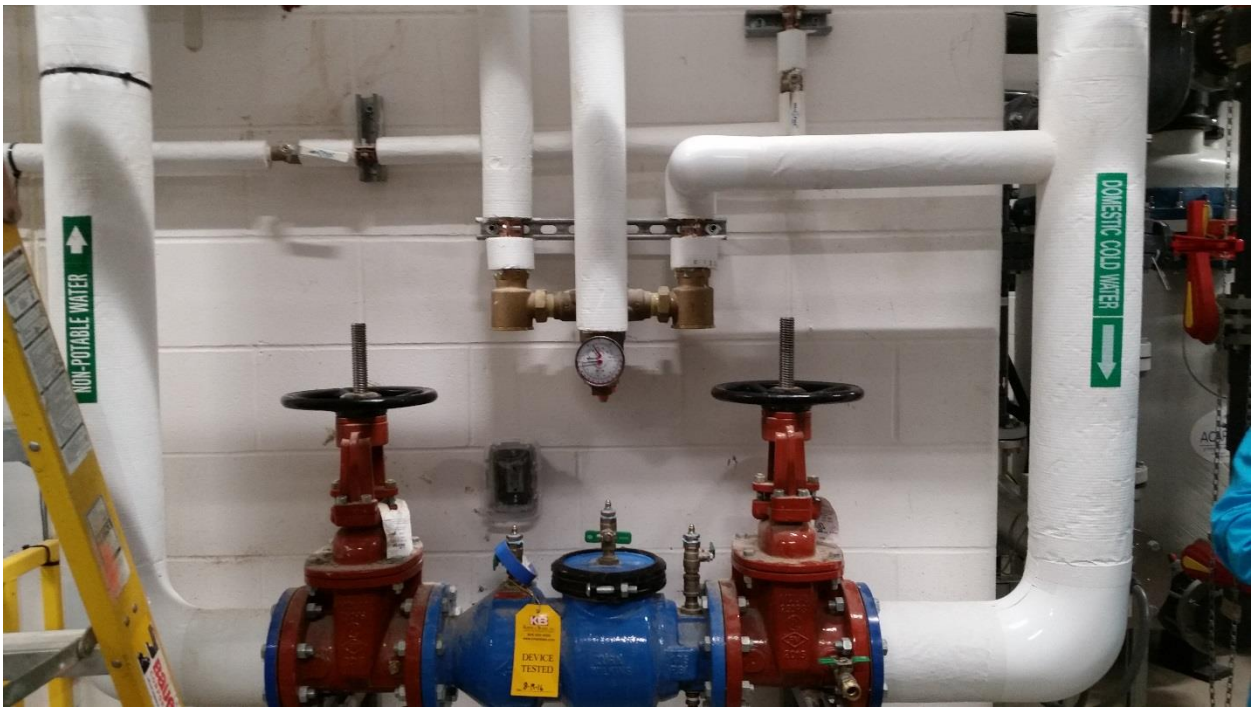
CITY OF SIOUX FALLS
PUBLIC WORKS
Providing a Better Quality of Life for You!

City of Sioux Falls, South Dakota



Cross-Connection Control Manual

Approved by Plumbing Board of Appeals
September 12, 2006
Revised and Adopted February 10th, 2017

INDEX

Section 1. Cross-Connection Control—General Policy

1.0 Purpose

The purpose of this program is:

1.0.1 To protect the public potable water supply of the City of Sioux Falls, SD, from the possibility of contamination or pollution by isolating within the customer's internal distribution system(s) or the consumer's private water system(s) such contaminants or pollutants which could backflow into the public water systems; and

1.0.2 To promote the elimination or control of existing cross-connections, actual or potential, between the consumer's in-plant potable water system(s) and non-potable water system(s), plumbing fixtures, and industrial piping systems; and

1.0.3 To provide for the maintenance of a continuing Program of Cross-Connection Control, which will systematically and effectively prevent the contamination or pollution of all potable water systems.

1.1 Responsibility

The City of Sioux Falls shall be responsible for the protection of the public potable water distribution system from contamination or pollution due to the backflow of contaminants or pollutants through the water service connection. If, in the judgment of the City of Sioux Falls, an approved backflow prevention assembly is required at the consumer's water service connection or within the consumer's private water system for the safety of the water system, the City of Sioux Falls shall give notice in writing to said customer to install such an approved backflow prevention assembly(s) at a specific location(s) on his/her premises. The consumer shall immediately install such an approved backflow prevention assembly(s) at the consumer's own expense; and, failure, refusal, or inability on the part of the consumer to install, have tested, and maintained said assembly(s) shall constitute grounds for discontinuing water service to the premise until such requirements have been satisfactorily met.

Section 2. Definitions

2.0 Approved

Accepted by the City of Sioux Falls as meeting an applicable specification stated or cited in this document or as suitable for the proposed use.

2.1 Auxiliary Water Supply

Any water supply on or available to the premise other than the purveyor's approved public water supply. These auxiliary waters may include water from another purveyor's public potable water supply or any natural source(s) such as a well, spring, river, stream, etc.

2.2 Backflow

The undesirable reversal of flow in a potable water distribution system as a result of a cross-connection.

2.3 Backpressure

A pressure, higher than the supply pressure, caused by a pump, elevated tank, boiler, or any other means that may cause backflow.

2.4 Backsiphonage

Backflow caused by negative or reduced pressure in the supply piping.

2.5 Backflow Preventer

An assembly or means designed to prevent backflow.

2.5.1 Air Gap. A physical separation between the free-flowing discharge end of a public potable water supply pipeline and an open or non-pressure receiving vessel. The vertical, physical separation shall be at least twice the diameter of the water supply pipe measured vertically above the flood-level rim of the vessel, in no case less than 1 inch.

2.5.2 Reduced Pressure Principle Backflow Prevention Assembly. An assembly containing two independently acting approved check valves together with a hydraulically operating, mechanically independent, pressure differential relief valve located between the check valves and below the first check valve. The unit shall include properly located resilient-seated test cocks and tightly closing resilient-seated shutoff valves at each end of the assembly.

2.5.3 Double Check Valve Backflow Prevention Assembly. An assembly containing two independently acting approved check valves, including tightly closing shutoff valves attached at each end of the assembly and fitted with properly located resilient-seated test cocks.

2.6 Backflow Prevention Assembly Tester

A person who has demonstrated proficiency in backflow prevention assembly testing by certification through a recognized third party certification organization using the backflow prevention assembly field test procedures listed in the most current edition of the *Manual of Cross-Connection Control*, published by the University of Southern California's Foundation for Cross-Connection Control and Hydraulic Research and is on the "approved tester" list of the City of Sioux Falls Public Works, Water Division. .

2.7 Contamination

An impairment of a potable water supply by the introduction or admission of any foreign substance that degrades the quality and creates a health hazard.

2.8 Cross-Connection

A connection or potential connection between any part of a potable water system and any other environment containing other substances in a manner that, under any circumstances, would allow such substances to enter the potable water system. Other substances may be gases, liquids, or solids, chemicals, waste products, steam, water from other sources, potable or non-potable, or any matter that may change the color or add odor to the water. A direct cross-connection shall mean a cross-connection which is subject to both backpressure and backsiphonage. An indirect cross-connection shall mean a cross-connection which is subject to backsiphonage only.

2.9 Cross-Connection—Controlled

A connection between a potable water system and a non-potable water system with an approved backflow prevention assembly properly installed, maintained and tested as required so that it will continuously afford the protection commensurate with the degree of hazard.

2.10 Cross-Connection Control by Containment

Prevents the impairment of the public potable water supply by installing an approved backflow prevention assembly at the service connection to any customer's premises, commensurate with the degree of hazard of the consumer's potable water system.

2.11 Cross-Connection Control by Isolation

To confine a localized hazard within a consumer's water system by installing approved backflow prevention assemblies, commensurate with the degree of hazard of the consumer's potable water system.

Disclaimer: The water purveyor (City of Sioux Falls) may make recommendations, upon facility inspection, as to the usages of isolation devices/assemblies, but does not assume or have responsibility whatsoever for such installations.

2.12 Degree of Hazard

The term is derived from an evaluation of the potential risk to public health and the adverse effect of the hazard upon the potable water system.

2.12.1 Hazard—Health. An actual or potential cross-connection involving any substance that could, if introduced into the potable water supply, cause death or illness, spread disease, or have a high probability of causing such effects.

2.12.2 Hazard—Plumbing. A plumbing-type cross-connection in a consumer's potable water system that has not been properly protected by an approved air gap or backflow prevention assembly.

2.12.3 Hazard—Non-Health. An actual or potential cross-connection involving any substance that generally would not be a health hazard, but would constitute a nuisance or be aesthetically objectionable, if introduced into the potable water supply.

2.12.4 Hazard—System. An actual or potential threat of severe damage to the physical properties of the public potable water system or the consumer's potable water system or a pollution or contamination that would have a protracted effect on the quality of the potable water in the system.

2.13 Industrial Fluids System

Any system containing fluid or solution that may be chemically, biologically, or otherwise contaminated or polluted in a form or concentration, such as would constitute a health, system, pollution, or plumbing hazard, if introduced into an approved water supply. This may include, but not be limited to, polluted or contaminated waters; all types of process waters and used waters originating from the public potable water system that may have deteriorated in sanitary quality; chemicals in fluid form; plating acids and alkalis; circulating cooling waters connected to an open cooling tower; and/or cooling towers that are chemically or biologically treated or stabilized with toxic substances; contaminated natural waters, such as wells, springs, streams, rivers, irrigation canals or systems, and so forth; oils, gases, glycerin, paraffins, caustic and acid solutions, and other liquid and gaseous fluids used in industrial or other purposes for firefighting purposes.

2.14 Pollution

The presence of any foreign substance in water that impairs the quality of the water to a degree which does not create a hazard to the public health, but which does adversely and unreasonably affect the aesthetic qualities of such waters for domestic use.

2.15 Water—Potable

Water which has been approved for human consumption by the health agency having jurisdiction.

2.16 Water—Non-potable

Water which has not been approved for human consumption by the health agency having jurisdiction.

2.17 Water—Service Connection

The terminal end of a service connection from the public potable water system, that is, where the water purveyor loses jurisdiction and sanitary control over the water at its point of delivery to the consumer's water system. If a meter is installed at the end of the service connection, then the service connection shall mean the downstream end of the meter. There should be no unprotected takeoffs from the service line ahead of any meter or backflow prevention assembly located at the point of delivery to the customer's water system. Service connection shall also include water service connections from a fire hydrant and all other temporary or emergency water service connections from the public potable water system.

2.18 Water—Used

Any water supplied by a water purveyor from a public potable water system to a consumer's water system after it has passed through the point of delivery and is no longer under the sanitary control of the water purveyor.

Section 3. Requirements

3.0 Water System

3.0.1 The water system shall be considered as made up of two parts: the utility system and the customer system.

3.0.2 The utility system shall consist of the source facilities and the distribution system and shall include all those facilities of the water system under the complete control of the utility, up to the point where the customer's system begins.

3.0.3 The source shall include all components of the facilities utilized in the production, treatment, storage, and delivery of water to the distribution system.

3.0.4 The distribution system shall include the network of conduits used for the delivery of water from the source to points of use.

3.0.5 The customer's system shall include those parts of the facilities beyond the termination of the utility distribution system that are utilized in conveying utility-delivered domestic water to points of use.

3.1 Policy

3.1.1 No water service connection to any premises shall be installed or maintained by the water purveyor unless the water supply is protected as required by state/provincial laws and regulations and this document. Service of water to any premises shall be discontinued by the water purveyor if a backflow prevention assembly required by this document is not installed, tested, and maintained, or if it is found that a backflow prevention assembly has been removed, modified, bypassed, or if an unprotected cross-connection exists on the premises. Service will not be restored until such conditions or defects are corrected.

3.1.2 The consumer's system shall be open for inspection at all reasonable times to authorized representatives of the City of Sioux Falls to determine whether cross-connections or other structural or sanitary hazards, including violations of these regulations, exist. When such a condition becomes known, the City of Sioux Falls shall deny or immediately discontinue service to the premises by providing for a physical break in the service line until the customer has corrected the condition(s) in conformance with state/provincial and City statutes relating to plumbing and water supplies and the regulations adopted pursuant thereto.

3.1.3 An approved backflow prevention assembly shall be installed on each service line to a customer's water system at or near the property line or immediately inside the building being served; but in all cases, before the first branch line leading off the service line wherever the following conditions exist:

3.1.3.1 In the case of premises having an auxiliary water supply that is not or may not be of safe bacteriological or chemical quality and that is not acceptable as an additional source by the City of Sioux Falls, the public water system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line, appropriate to the degree of hazard.

3.1.3.2 In the case of premises on which any industrial fluids or any other objectionable substances are handled in such a fashion as to create an actual or potential hazard to the public water system, the public water system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line, appropriate to the degree of hazard. This shall include the handling of process waters and waters originating from the utility system that have been subject to deterioration in quality.

3.1.3.3 In the case of premises having internal cross-connections that cannot be permanently corrected and controlled, or intricate plumbing and piping arrangements or where entry to all portions of the premises is not readily accessible for inspection purposes, making it impracticable or impossible to ascertain whether or not dangerous cross-connections exist, the public water system shall be protected against backflow from the premises by installing an approved backflow prevention assembly in the service line.

3.1.4 The type of protective assembly required for containment under subsections 3.1.3.1, 3.1.3.2, and 3.1.3.3 shall depend upon the degree of hazard that exists as follows:

3.1.4.1 In the case of any premises where there is an auxiliary water supply as stated in subsection 3.1.3.1 of this section and it is not subject to any of the following rules, the public water system shall be protected by an approved air gap separation or reduced pressure principle backflow prevention assembly.

3.1.4.2 In the case of any premises where there is water or substances that would be objectionable, but not hazardous to health if introduced into the public water system, the public water system shall be protected by an approved double check valve assembly.

3.1.4.3 In the case of any premises where there is any material dangerous to health that is handled in such a fashion as to create an actual or potential hazard to the public water system, the public water system shall be protected by an approved air-gap separation or reduced-pressure principle backflow prevention assembly. Examples of premises these conditions will exist, but are not limited to, include sewage treatment plants, sewage pumping stations, chemical manufacturing plants, hospitals, mortuaries, and metal plating facilities.

3.1.4.4 In the case of any premises where there are uncontrolled cross-connections, either actual or potential, the public water system shall be protected by an approved air-gap separation or reduced-pressure principle backflow prevention assembly at the service connection.

3.1.4.5 In the case of any premises where, because of security requirements or other prohibitions or restrictions, it is impossible or impractical to make a complete in-plant cross-connection survey, the public water system shall be protected against backflow from the premises by either an air-gap separation or reduced-pressure principle backflow prevention assembly on each service to the premises.

3.1.4.6 In the case of any premises where, in the opinion of the City of Sioux Falls, an undue health threat is posed because of the presence of extremely toxic substances, the City of Sioux Falls may require an air gap at the service connection to protect the public water system. This requirement will be at the discretion of the City of Sioux Falls and is dependent on the degree of hazard.

3.1.5 Any backflow prevention assembly required herein shall be a make, model, and size approved by the City of Sioux Falls. The term *approved backflow prevention assembly* shall mean an assembly that has been manufactured in full conformance with the most current edition of the standards established by the American Water Works Association titled:

- ANSI/AWWA C510 *Standard for Double Check Valve Backflow Prevention Assembly.*
- ANSI/AWWA 511 *Standard for Reduced Pressure Principle Backflow Prevention Assembly.*

and have met completely the laboratory and field performance specifications of the Foundation for Cross-Connection Control and Hydraulic Research (FCCCHR) of the University of Southern California established in:

> "Specifications of Backflow Prevention Assemblies"—Section 10 of the most current edition of the *Manual of Cross-Connection Control.*

Said AWWA and FCCCHR standards and specifications have been adopted by the City of Sioux Falls. Final approval shall be evidenced by a "Certificate of Approval" issued by an approved testing laboratory certifying full compliance with said AWWA standards and FCCCHR specifications. The following testing laboratory has been qualified by the City of Sioux Falls to test and certify backflow prevention assemblies:

> Foundation for Cross-Connection Control and Hydraulic Research
> University of Southern California
> KAP-200 University Park MC-2531
> Los Angeles, California 90089-2531

Testing laboratories, other than the laboratory listed above, will be added to an approved list as they are qualified by the City of Sioux Falls.

Backflow preventers that may be subjected to backpressure or backsiphonage that have been fully tested, and have been granted a certificate of approval by said qualified laboratory, and are listed on the laboratory's current list of approved backflow prevention assemblies may be used without further testing or qualification.

3.1.6 It shall be the duty of the customer at any premises where backflow prevention assemblies are installed to have a field test performed by a backflow prevention assembly tester at the time of installation, repair, relocation, and at least on an annual basis or when required by the authority having jurisdiction. In those instances where the City of Sioux Falls deems the hazard to be great enough, field tests may be required at more frequent intervals. These tests shall be at the expense of the water user.

3.1.7 All presently installed backflow prevention assemblies that do not meet the requirements of this section, but were approved assemblies for the purpose described herein at the time of installation and that have been properly maintained, shall, except for the testing and maintenance requirements under subsection 3.1.6, be excluded from the requirements of these rules so long as the City of Sioux Falls is assured that they will satisfactorily protect the water purveyor's system. Whenever the existing assembly is moved from the present location, requires any maintenance, or when the City of Sioux Falls determines that the assembly is not commensurate with the degree of hazard it was installed to protect, the unit shall be replaced by an approved backflow prevention assembly meeting the requirements of this section.

3.1.8 The City of Sioux Falls is authorized to make all necessary and reasonable rules and policies with respect to the enforcement of this document.

3.2 Type of Protection Required for Specific Facilities

3.2.1 The following commercial/industrial facilities shall have an approved air-gap or reduced-pressure principle backflow prevention assembly installed on each service line:

- Aircraft or missile plants.
- Automotive plants.
- Breweries.
- Canneries, packing houses, and rendering plants.

- Car/truck wash facilities.
- Chemical Plants—manufacturing, processing, compounding, or treatment.
- Chemically contaminated water systems
- Film laboratories.
- Hospitals, medical buildings, sanitariums, morgues, mortuaries, autopsy facilities, nursing/convalescent homes and clinics.
- Laundries and dye works.
- Malls or strip malls
- Oil and gas production, storage, or transmission properties.
- Paper and paper products plants.
- Plating plants.
- Power plants.
- Radioactive materials or substances—plants or facilities handling restricted, classified, or other closed facilities.
- Rubber plants—natural or synthetic.
- Sand and gravel pits.
- Schools and colleges.
- Sewage and storm drain facilities, reclaimed water systems.

3.2.2 Commercial/industrial facilities not included in subsection 3.2.1 that contain a health hazard shall have an approved air-gap or reduced-pressure principle backflow prevention assembly installed on each service line.

3.2.3 All other facilities shall have a minimum of an approved double check valve backflow prevention assembly installed on each service line.

3.2.4 An exception to 3.2.3 shall be made to allow a minimum of a dual check backflow preventer, which conform to ASSE 1024, be installed on each service line in residential single family, duplex, twin home, and multi-family facilities with three or fewer dwelling units served by a single service.

3.3 Testing of Backflow Prevention Assemblies

3.3.1 Testing of backflow prevention assemblies shall be performed by a City of Sioux Falls approved backflow prevention assembly tester.

3.3.2 Testing shall be performed in accordance with the field test procedures listed in the most current edition of the *Manual of Cross-Connection*

Control, published by the University of Southern California's Foundation for Cross-Connection Control and Hydraulic Research.

3.3.3 After every assembly is tested, it must have a tag displayed from the assembly clearly outlining the following information: Company name and contact phone number, date of test, tester name, test results (PSI, appropriately marked answers) and a definitive pass or fail.

3.3.4 Records of all failed and successful tests and repairs shall be documented on a City of Sioux Falls backflow prevention assembly test report by the backflow prevention assembly tester. When an existing backflow prevention assembly is repaired, the test report shall include the steps taken to repair the assembly along with a list of materials or replacement parts used.

3.3.5 Copies of the test reports shall be signed and submitted to the Water Program Coordinator of the City of Sioux Falls Public Works Water Division. This can be done electronically via email or fax and by U.S. mail.

3.3.6 Copies of the test reports shall be submitted to the City of Sioux Falls Water Division within seven (7) calendar days of completing such tests and repairs.

3.3.7 The backflow prevention assembly tester shall keep copies of the test reports for a minimum of five years.

3.2.8 Test reports shall be completed in ink.

3.2.9 The initial testing of a backflow prevention assembly must be completed as soon as the water service has been activated.

3.4 Backflow Prevention Assembly Tester Certification

3.4.1 To be approved by the City of Sioux Falls as a backflow prevention assembly Tester will require the following:

3.4.1.1 Completion of a backflow prevention assembly tester application form available from the Water Division.

3.4.1.2 Submission of a copy of the certificate for the successful completion of a course on the subject of cross-connections and operation, maintenance, testing, and repairs of backflow prevention assemblies.

3.4.1.3 Submission of the make, model, and serial number, each test kit used by the backflow prevention assembly tester.

3.4.1.4 Submission of a copy of ABPA license.

3.4.2 The City of Sioux Falls will require certification by American Backflow Prevention Certification (ABPA) as a means of attaining tester certification.

3.4.2.1 ABPA certification will be in the field test procedures listed in the current edition of the *Manual of Cross-Connection Control*, published by the University of Southern California's Foundation for Cross-Connection Control and Hydraulic Research.

3.4.3 The tester is responsible for maintaining valid certification status with ABPA and providing acceptable documentation to the City of Sioux Falls.

3.4.4 Certification will expire per American Backflow Prevention Association (ABPA) recertification schedules for each Tester.

3.4.5 A certified backflow tester has specialized knowledge of backflow prevention and cross-connection control. Therefore, by submitting reports to the City of Sioux Falls and being on the approved tester list, trained and certified testers are required to report unprotected cross connections, unprotected service lines, improper installations, (by UPC or this document) modified or un-approved assemblies, or anything that may compromise the safety of the building owner's water system or the Municipal water supply.

3.4.6 Falsification of the backflow prevention assembly tester application form or any other City of Sioux Falls backflow prevention paperwork shall result in immediate decertification from the City of Sioux Falls "Backflow Prevention Assembly Tester Approved List."

Section 4. Requirements for Designing Backflow Prevention Assembly Installations

4.0 Purpose

The purpose of this section is to outline the minimum installation requirements for backflow preventers in the City of Sioux Falls, SD Cross-Connection Control Manual. These requirements reflect accepted design considerations based on experience in implementing cross-connection control programs and policies set forth by the American Water Works Association, Environmental Protection Agency, USC Foundation for Cross-Connection Control and Hydraulic Research, and state and local health departments. Pending revisions to the manual, these guidelines should clearly outline what an acceptable design and installation constitutes. They are to be reasonably interpreted and will be updated as new design solutions and technologies are offered.

General Installation Details

4.1 Clearances

All double check valve (DC) and reduced pressure principal (RP) backflow prevention assemblies are designed for in-line service and must be installed to prevent freezing, flooding, and mechanical damage with adequate space to facilitate maintenance and testing. Ideally, the installation should not require platforms, ladders, or lifts for access. Adequate clearances from floors, ceilings, and walls must be provided to access the test cocks and to allow the repair and/or removal of the relief valve and check valves; as follows:

4.1.1 All assemblies shall be installed a minimum of 12 inches above the floor, from the lowest point of the assembly, and less than 60 inches above the floor from the highest point of the assembly. Any installation at a greater height shall be provided with a fixed platform, a portable scaffold or lift, any of which meeting OSHA standards. For the safety of testing and maintenance personnel, large or heavy assemblies should be installed at 30 to 36 inches above the floor, from the lowest point of assembly, to allow for ease of access, testing, maintenance and repair. Special consideration should be made for vertical installations of large diameter assemblies to facilitate repairs.

4.1.2 All RP assemblies must have a 12-inch minimum clearance between the bottom of the relief valve and the floor to prevent submersion and provide access to the relief valve for servicing and testing.

4.1.3 A minimum of 12 inches of clear space shall be maintained above the assembly to allow for servicing check valves and for operation of shut-off valves. More distance will be required for larger assemblies.

4.1.4 A minimum of 30 inches of clear space shall be maintained between the front side of the device and the nearest wall or obstruction. More distance will be required for larger assemblies.

4.1.5 At least 12 inches clearance shall be maintained from the test cocks of the assembly to the nearest wall or obstruction. This clearance may need to be increased for models that have side-mounted test cocks or relief valves that would be facing the back wall.

4.1.6 Multiple assemblies installed in a manifold or parallel manner shall not be installed one directly over another. Assemblies must be side by side or at a 45-degree angle and comply with all of the requirements in this section.

4.1.7 Assemblies must NOT be installed directly above, or where their operation, testing and maintenance may result in damage to the water meter.

4.1.8 Containment Backflow Preventers must be installed immediately *FOLLOWING* the water meter and before any branch piping. If a PRV is required, it must be installed after the water meter and backflow.

4.2 Miscellaneous Considerations

4.2.1 All assemblies shall be adequately supported and/or restrained to prevent lateral movement. Pipe hangers, braces, saddles, stanchions, piers, etc., should be used to support the device and should be placed in a manner that will not obstruct the function of or access to the check valves or relief valve.

4.2.2 Strainers for backflow assemblies are not required. If a strainer is installed, it must not have a tapped port and there must be an isolation valve ahead of it for strainer maintenance. **No strainer is to be used in a fire line without the approval of the Insurance Underwriters or the Authority Having Jurisdiction.**

4.2.3 The assembly should be sized hydraulically, taking into account both the flow requirements of the service and the head loss of the assembly. The head loss of the assembly is not necessarily directed proportional to flow. (Refer to the manufacturer's head loss curves).

4.2.4 Thermal water expansion and/or water hammer downstream of the assembly can cause excessive pressure. To avoid possible damage to the system and assembly, use water hammer arresters, surge protectors or expansion tanks as required by code.

4.2.5 All assemblies should be specified and installed with the manufacturer supplied resilient seated shut-off valves integral to the assembly. Shut-off valves on a backflow assembly from the factory are intricate part of the assembly and factor into the assemblies' approval. These shut offs DO NOT replace, and should not be designed or installed to be used as, the shut off for the service line to make repairs or for maintenance. An approved, separate shut off valve must be used in conjunction with the assembly.

4.2.6 Waterlines must be thoroughly flushed with the appropriate flow velocity before installing the assembly. Most test failures on new installation are the result of debris fouling one of the check valves or the relief valve.

4.2.7 All assemblies must be installed horizontally unless they are specifically approved for vertical installation by The University of Southern California Foundation for Cross Connection Control and Hydraulic Research. **http://fccchr.usc.edu//list.html**
(ASSE or manufacturer's approval is not sufficient)

4.2.8 Parallel installation should be considered at those facilities where water service cannot be interrupted. Manifold installations may also be used.

4.2.9 Assemblies shall not be installed in areas containing corrosive, toxic, or poisonous fumes, gases or confined spaces which could render the assembly inoperable or pose a safety hazard to personnel.

4.2.10 Because of the inherent design of a reduced pressure backflow assembly, fluctuating supply pressure on an extremely low flow or static flow condition may cause nuisance dripping and potential fouling of the assembly. While not effective in all cases, the installation of a soft seated check valve immediately ahead of the RP will often hold the pressure constant to the assembly in times of fluctuating supply pressure. The installation of any piping or equipment ahead of the containment backflow assembly will not be allowed without written permission from the City of Sioux Falls Water Division.

4.2.11 Where the distance between the water meter and the device is greater than 1.0 foot, all exposed piping should be stenciled "Feed Line to Backflow Preventer—DO NOT TAP" at 5-foot intervals.

4.3 Drainage

4.3.1 Drainage for backflow prevention assemblies shall be provided for **all** installations of DC or RP to accommodate discharge during testing or draining of the unit and for RP relief valve discharges, as follows:

4.3.1.1 For RP devices, drainage capacity shall be sized to accommodate both intermittent discharges **and** a catastrophic failure of the relief valve. Refer to manufacturers flow curves to determine maximum discharge rate based on supply pressure or on-site pressure; whichever is greater.

4.3.1.2 Discharge from relief valves must be readily detectable to maintenance personnel either visually or by means of water level alarms, flow indicator lights, etc.

4.3.1.3 All drainage from RPs must be by gravity drains. Sump pumps are not allowed unless they are sized to accommodate the maximum discharge rate **and** connected to emergency power supplies.

4.3.1.4 An air gap must be maintained between the RP relief valve opening and any discharge piping. The air gap must be at least twice the dimension of the effective opening of the relief valve; but in no case less than 1.0 inch.

4.3.1.5 Manufacturer's air gap fittings may be utilized provided that they maintain a proper air gap and do not enclose or cover the relief valve. These fittings are only sized to handle intermittent and low flow discharges. Additional drainage capacity may be required to accommodate a catastrophic relief valve failure.

4.3.1.6 Discharge piping from relief valves shall be terminated a minimum of one inch above any floor drain or other receiving receptacle.

4.3.1.7 Discharge piping connected to a storm sewer shall not be allowed without written permission from the authority having jurisdiction.

4.3.1.8 Discharge piping connected to a sanitary sewer shall not be allowed without written permission from the authority having jurisdiction.

4.3.1.9 Discharge piping from pits or other structures must be terminated above grade in an area not subject to flooding (generally one foot above the 100-year flood elevation). The terminal end of the discharge piping must have a rodent screen and may need to be supported by a headwall. Steps should be taken to ensure cold air cannot flow back through the exterior drain into the relief and freeze the relief.

4.3.1.10 All exterior drains shall be kept free of snow during winter.

4.4 Pit Installations

Due to considerations for confined space safety and gravity drainage, backflow prevention assemblies shall not be installed in pits without written permission from the authority having jurisdiction. Where pit installations are approved they shall be designed.

4.4.1 To be watertight with watertight manholes or access doors extending a minimum of 6 inches above grade and located to allow natural light into the pit during testing/maintenance.

4.4.2 With stairways, ladders, or step irons.

4.4.3 For crane access for installing and removing large assemblies.

4.4.4 With adequate horizontal and vertical clearances to allow access to the device.

4.4.5 With a full flow screened gravity drain terminating above grade for all RP installations as detailed in the drainage requirements.

4.4.6 With sump pumps or gravity daylight drains for all DC installations.

4.4.7 With floors pitched to drain.

4.4.8 With adequate ground cover to prevent freezing.

4.4.9 With surface grading to divert runoff away from the entrance way.

4.4.10 Semi-buried pits for berm installations may be necessary to satisfy gravity drainage requirements.

4.5 Above-grade Installations—Protective Enclosures

An above-grade installation is generally necessary to provide gravity drainage from RP devices. The additional benefits of improved access and enhanced safety are also realized with an above grade installation. Prefabricated insulated enclosures that provide heat, gravity drainage, and removable access panels for servicing and testing should be used whenever possible. As an alternate, wood frame, fiberglass, steel, masonry, or precast concrete structures may be utilized. All enclosures shall be designed:

4.5.1 With a floor elevation that is at least 6 inches above finished grade.

4.5.2 To provide adequate clearances around the device to access the test cocks, shutoff valves, check valves, and relief valve.

4.5.3 With electric heaters or heat trace wire for any water service used year-round.

4.5.4 With provisions for natural or artificial light.

4.5.5 With full flow gravity drains according to the drainage requirements.

4.5.6 With security measures such as locking doors and panels, flow alarms, or flow indictor lights, power indicator lights, etc.

4.6 Installation Within A Building

Access and drainage considerations must be satisfied and the devices should be located to avoid electrical panels, areas of excessive heat, etc.

4.6.1 Above grade installations shall be provided with adequate clearances and discharge can be directed to floor or drains or through a sidewall above grade via screened louvers, scuppers, pipe sleeves with flap valves, etc., in accordance with the drainage requirements.

4.6.2 Below grade or basement installations are acceptable for DCs. RPs are only allowed below grade where one or more of the following conditions can be met:

4.6.2.1 Where an adequate gravity drainage system is provided to accommodate a relief valve failure.

4.6.2.2 Where water level alarms are installed to detect flow from the device and alert maintenance or security personnel.

4.6.2.3 Where sump pumps are sized to accommodate a relief valve failure and are connected to emergency power.

4.6.2.4 Where the floor area and volume below the device could accommodate discharge from a relief valve failure. For 2-inch and smaller units, 2,000 cubic feet is generally acceptable. For larger units, the time to submerge the device based on the maximum discharge rate and floor area/volume should be no less than 8 hours.

In any of the above cases, **the property owner must be made aware of the potential for water damage in the event of a discharge.**

4.7 Submission and Approval of Plans

The submission of plans and specifications for the installation of backflow prevention assemblies must include the following:

4.7.1 A **site plan** (to scale or with dimensions) of the facility containing a general location map, name and address of facility, property lines, buildings, the size and location of public water main(s) and all fire and domestic water services, meter pits, yard piping and hydrants, pumper connection(s), interconnections, and the location of the proposed backflow preventer(s).

4.7.2 A **plumbing floor plan** (plan view) or **partial floor plan** indicating water services, name and address of facility, water meter layout, proposed backflow preventer(s), booster pump system, floor drain(s) and all nearby objects (examples: electrical panels, boilers, chillers, storage tanks, fire pumps, fire sprinkler risers, etc.). The plan must be drawn **to scale or with dimensions** indicated from walls and all nearby objects.

4.7.3 A **vertical cross section(s)** of the proposed installation with elevations from floor, ceiling, outside grade and all nearby objects.

4.7.4 All drawings must include the name and address of the facility, be stamped and signed by the designer, and have a clear space for approval stamps.

4.8 Engineer's Report

An engineering report must be included with the plan submittal. The report must describe the project in **detail**. Items that should be included or described in the report include:

4.8.1 General use of water within the facility.

4.8.2 Size and description of all fire and domestic water services.

4.8.3 Number of floors within the facility.

4.8.4 Actual or estimated maximum flow demand.

4.8.5 Pressures—existing and after the installation of the backflow preventer.

4.8.6 Description of the firefighting system—indicate the A.W.W.A. Manual M-14 class of sprinkler service.

4.8.7 Description of the proposed installation of the backflow preventer—indicate the location of backflow preventer, drainage, lighting, heating, and access to unit.

4.8.8 Description of the existing or proposed booster pump system, answering the following questions:

4.8.8.1 After the installation of the proposed backflow preventer(s), will the Net Positive Suction Head (NPSH) required for the proper operation of the booster pump system be adequate?

4.8.8.2 After the installation of the backflow preventer(s) in the suction line to the booster pump system, will the booster pump system operate properly at peak demand to deliver adequate pressure to the highest elevation and/or most remote fixture unit or any other operation requiring a certain pressure?

4.8.8.3 Does the booster pump system have a pressure cutoff switch in the suction line? What is the pressure setting of the switch?

4.8.9 Is there a need for parallel backflow preventers? Does the facility need a continuous water supply?

4.8.10 An inventory of any existing containment devices/assemblies to include the make, model, size, and serial number of the device. Current annual test reports must also be submitted. The degree of hazard for these services must be determined to ensure that the device provides the correct protection.

4.9 Certified Testing and Completed Works Approval

After an approval of plans has been issued and the assembly has been installed, it must be tested by a certified tester. The designer (or authority having jurisdiction) is then responsible to certify that the installation was done in accordance with approved plans; or describe any changes or submit “As Built” plans as appropriate.

The initial test results and certification of correct installation must be submitted to the water supplier and approving agent for issuance of a Certificate of Occupancy for both the certified test results and the designer’s certification of the installation.

After issuance of the Certificate of Occupancy, the assembly must be tested at least annually by a certified tester with the results reported to the water supplier.