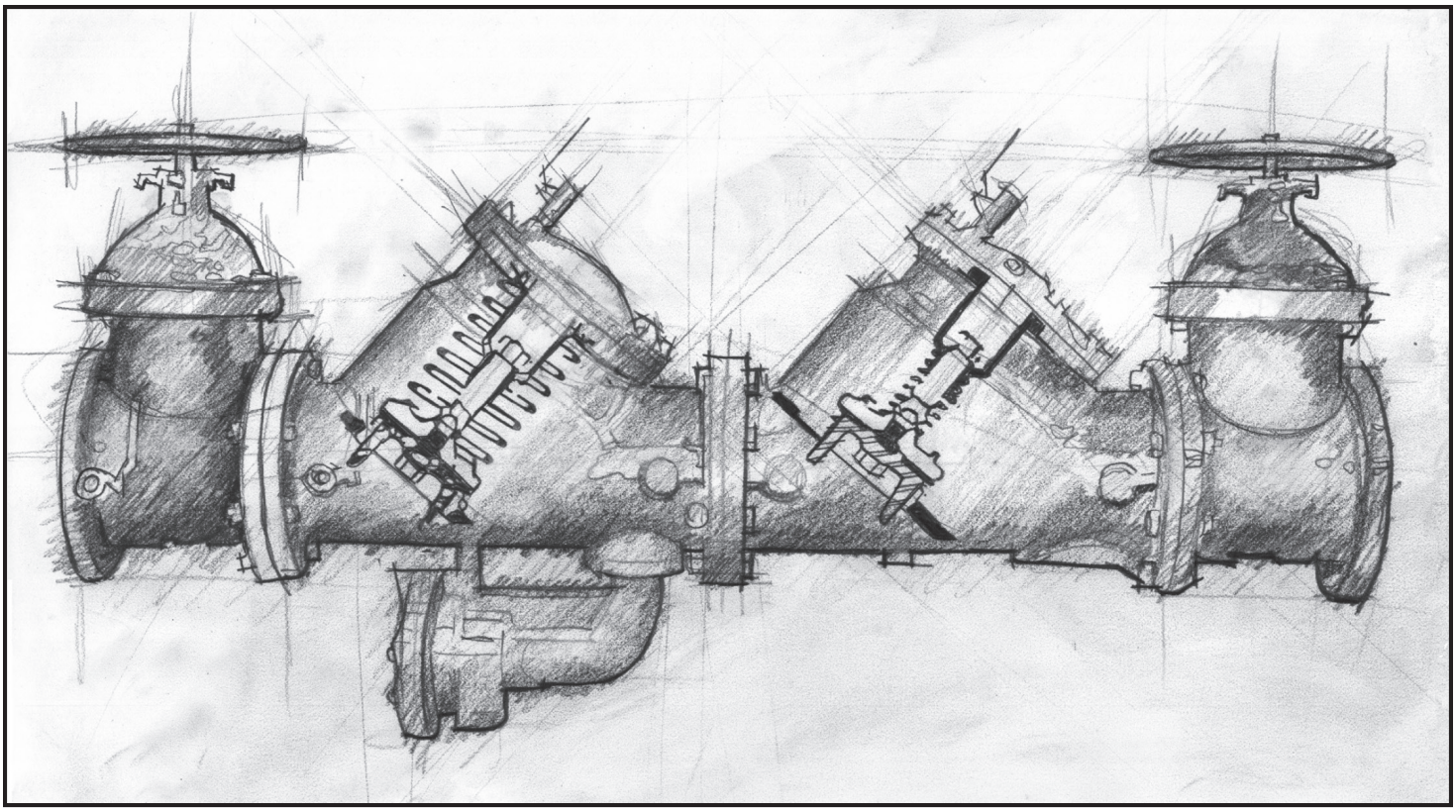
BACKFLOW PREVENTION

Tester Certification Course



dhec

Healthy People. Healthy Communities.

Bureau of Water

South Carolina Department of Health
and Environmental Control

SC DHEC
Cross-Connection Control/Backflow Prevention

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Columbia, SC 29201
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LEGAL AUTHORITY

The legal authority for the enforcement of the State Primary Drinking Water Regulations is provided through the State Safe Drinking Water Act, As Amended July 1, 1994. Only a couple of sections in that document apply to cross-connections. Those sections are covered below.

44-55-20 Definitions.

(d) "Cross-connections" means any actual or potential connection or structural arrangement between a public water supply and any other source or system through which it is possible to introduce into any part of the potable system any used water, industrial fluid, gas or substance other than the intended potable water with which the system is supplied. By-pass arrangements, jumper connections, removable sections, swivel or changeover devices and other temporary or permanent devices through which or because of which backflow can or may occur are considered to be cross-connections.

Note that the legal definition of cross-connections refers to actual, as well as, potential cross-connections. Any by-pass arrangement, jumper connection, removable sections, swivel or changeover devices, either temporary or permanent, which may serve as passage ways through which water may travel are considered to be cross-connections under this definition.

44-55-40. Applications - Requirements.

(d) Any public water supply shall be adequately protected and maintained so as to continuously provide safe and potable water in sufficient quantity and pressure and free from potential hazards to the health of the consumers. No person shall install, permit to be installed or maintain any unprotected cross-connection between a public water supply and any other water system, sewer or waste line or any piping system or container containing polluting substances. To facilitate the prevention and control of cross-connections, the Department shall certify qualified individuals who are capable of testing cross-connection control devices to insure their proper operation.

The State Safe Drinking Water Act is directed primarily toward the Water Purveyor, and clearly requires that office to adequately protect and maintain the potable water supply system, so as to continuously provide safe water free from potential hazards to the health of the consumer. This paragraph clearly lays the foundation for DHEC to require each system to initiate and maintain a viable cross-connection control program as covered in the State Primary Drinking Water Regulations.

f. CROSS CONNECTION CONTROL

(1) General

(a) All public water systems shall initiate and maintain a viable cross-connection-control program. Such a program shall consist of:
(i) Locating and eliminating unprotected cross-connections.

(ii) Maintaining records pertaining to the location of existing backflow prevention assemblies, type and size of each assembly and annual test results.

(b) No person shall install, permit to be installed or maintain any cross-connection between a public water system and any other non-public water system, sewer or a line from any container of liquids or other substances, unless an approved backflow prevention device or assembly is installed between the public water system and the source of contamination.

(2) Low Hazard Cross-Connections
A connection between an approved public water system and another water source not hazardous to health but not meeting the standards of the approved public water system and not cross-connected within its system with a potentially dangerous substance shall be considered a low hazard category cross-connection. At a minimum, an approved Double Check Valve Assembly or Pressure Vacuum Breaker must be installed on a low hazard cross-connection except as provided for in section 3 below.

(3) Residential Lawn Irrigation Systems

(a) Low hazard residential lawn irrigation systems - Each public water system which has low hazard residential irrigation systems directly or indirectly connected to their public water system must have a written low hazard residential lawn irrigation system cross-connection control policy. This policy must be documented in writing and must be approved by the governing body of the public water system. The policy must specify the minimum acceptable device for low hazard residential lawn sprinkler systems. The minimum acceptable device for low hazard residential lawn sprinkler systems is a residential dual check. If a water system specifies another backflow prevention assembly as the minimum acceptable protection for these cross-connections, the policy must be approved by the governing body of the public water system with due opportunity being provided for public comment and participation. The written policy must:

(i) Identify the type of backflow prevention device or assembly that is required to be installed on low hazard residential lawn irrigation system connections.

(ii) Establish a schedule for the required testing of double check valve assemblies, or other testable assembly, if testable assemblies are designated by the policy as minimum acceptable protection for low hazard residential lawn irrigation systems. The minimum testing frequency must be specified in the policy and

appropriate records must be maintained to verify compliance with the established testing requirements.

(iii) Establish a schedule for the required change out of residential dual checks if these are the devices designated by the policy as minimum acceptable protection for low hazard residential lawn irrigation systems. The minimum change out frequency must be specified in the policy and appropriate records must be maintained to verify compliance with the established change out requirements.

(b) High hazard residential lawn irrigation systems – Any residential lawn irrigation system that includes chemical addition, or is also connected to another water source which is not an approved public water system, shall be considered a high hazard cross-connection and must meet the requirements of paragraph (4) below.

(4) High Hazard Cross-Connections

(a) A connection between an approved public water system and a service or other water system which has or may have any material in the water dangerous to health, or connected to any material dangerous to health, that is or may be handled under pressure, or subject to negative pressure, shall be considered a high hazard category cross-connection. Protection shall be by air gap separation or an approved reduced pressure principle backflow prevention assembly.

(b) Reduced pressure principle backflow prevention assemblies shall not be installed in any location subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve.

(5) Fire Sprinkler Systems
Fire line sprinkler systems, except those in the high hazard category shall be protected by an approved double check valve assembly. High hazard fire sprinkler systems shall include, but not be limited to: antifreeze systems, foam systems, systems charged from or tied into ponds, lakes, streams, or any water source other than the approved public water supply. High hazard category fire sprinkler systems shall comply with the requirements of Paragraphs (4) above.

(6) Approved Devices and Assemblies
The Department shall prepare and publish a list of backflow prevention assemblies approved by the Department for use in S.C., and this list shall be updated at least once annually.

(7) Testing Requirements
When double check valve assemblies, pressure vacuum breakers, and/or reduced pressure principle backflow prevention assemblies are installed to protect a public water system against the possibility of backflow from a customer's water service, routine testing of the assemblies shall be performed by a certified tester.

(a) Each assembly shall be tested by a certified tester after installation and before use by the customer. Except as specified in paragraph 3(a)(ii) above, each assembly shall be tested at least once annually by a certified tester.

(b) The public water system is to receive a written report of the inspection and testing results for all assemblies tested within its distribution system. The report shall be submitted by the certified tester making the inspection and test.

(c) All backflow prevention assemblies shall be tested immediately after repairs of any kind are made to the assembly.

(8) Backflow Prevention Tester Certification
There are four (4) types of certified testers of backflow prevention assemblies; General Tester, Limited Tester, Inspector Tester, and Manufacturer's Agent. The definition of each type of certified tester is specified in R.61-58(A).

(a) Each certified tester's license shall expire three (3) years from the date of issue. In order to renew this certification for three (3) more years, the tester shall come before a designated person approved by the Department and shall successfully complete a written examination with a passing score of 70%, and perform the prescribed test on an approved reduced pressure principle backflow prevention assembly, double check valve assembly, and a pressure vacuum breaker using the tester's own differential pressure gauge. The gauge must be accurate within 2% of full scale or +/-0.3 pounds per square inch differential (PSID). Any gauge found to be inaccurate or malfunctioning will be required to be calibrated or repaired as needed to bring it into compliance before certification will be renewed.

(b) Any applicant for certification who fails to properly perform the above prescribed tests will have his certification revoked immediately and will have to successfully complete the state sponsored backflow prevention training and certification course in order to become re-certified as a tester of backflow prevention assemblies in South Carolina.

(c) A certified tester may have his tester's certification revoked due to incompetence or falsification of test results, as determined by the Department.

(d) The Department shall reserve the right to charge or allow for the charge of a nominal fee for the administration of the recertification of testers. This fee shall not exceed fifty dollars ($50.00).

(9) Installations of Pressure Vacuum Breakers
Where used, pressure vacuum breakers shall be installed at a minimum of 12" inches above the highest downstream piping and shall not be subject to backpressure.

CERTIFIED TESTERS CLASSIFICATIONS

R. 61-58 B (16)

Definition: "Certified Tester" means any person holding an up-to-date backflow prevention assembly tester certification card issued by the Department. Certified testers fall into one of the following four classifications.

(a) General Tester - any person who has successfully completed an approved backflow prevention training and certification course which is sponsored by or approved by the Department, and who has personal possession of or whose employer owns a backflow prevention assembly test kit. This person provides the service of testing backflow prevention assemblies to the general public.

(b) Inspector Tester - any person with the same qualifications as the General Tester, except the Inspector Tester must be employed by a municipality, water district, subdivision, or other public water system. The Inspector Tester is normally involved in the management of a backflow prevention program, and does not sell his services to the general public.

(c) Limited Tester - any person with the same qualification as the General Tester except the prescribed test(s) is (are) conducted only on backflow prevention assemblies which are owned by his employer. The Limited Tester does not provide testing services to the general public.

(d) Manufacturer's Agent - any person with the same qualifications as the General Tester except the prescribed test(s) is (are) conducted as an extension of his duties as a representative of aparticular backflow prevention company.

PURVEYOR'S RESPONSIBILITY

While it is true that many individuals are involved in the process of preventing cross-connections from occurring, the primary responsibility of implementing and maintaining a viable cross-connection control program rests with the Water Purveyor. The water purveyor may be a commission, a city or town, or even an individual person, such as the superintendent of water, city manager or mayor. Individuals such as plumbers, contractors, factory workers, and homeowners often create unprotected cross-connections which would impact the public water system, those individuals usually avoid prosecution, while the water purveyor is held responsible by the courts.

1. A city ordinance be enacted, outlining the cross-connection control program and providing enforcement authority. (DHEC offers a model ordinance and regulation to systems upon request)

2. One person should be delegated as the responsible person to carry out the program. Authority and backing must be provided from the appropriate person(s) for administering the program. It is essential that this individual be educated as to the causes and potential hazards of cross-connections, as well as how to properly prevent them.

3. All existing facilities where cross-connections are suspected should be listed on a priority basis and inspected.

4. Provisions should be made to route all applications for new services or for enlarging services through the person in charge of the cross-connection control program.

5. All new construction should be inspected for possible cross-connections. If possible, plans should be revised before construction.

6. A list of backflow devices approved by the State should be made available to each plumber, contractor, and water customers in order to insure uniformity and reliability.

7. A list of certified testers should be made available to water customers who are responsible for annual tests of backflow prevention devices.

8. Adequate records, including date(s) of inspection(s), results of inspection, recommended protection, list of all testable backflow prevention devices within the system, testing and maintenance reports, as well as all correspondences between the water purveyor, customer, contractor, etc.

9. A program must be established to notify the customer of the annual testing requirement. Newly installed RP's and DCVA's must be tested before approvals are issued for release to the owner for general use.

10. The program manager must work closely with the local plumbing inspection authority, as well as other city, county and state agencies which may impact the cross-connection control program in any way.

11. If immediate hazard to the public health is threatened by a cross-connection then water service to the premise in question should be disconnected until the cross-connection has been corrected.

12. Failure of the customer to cooperate in the installation, maintenance, testing or inspection of backflow prevention device(s) is grounds for the termination of water service to the premise in question. Authority to terminate the water service should be included in the city ordinance.

The water purveyor must recognize his responsibility in locating and eliminating all cross-connections within his distribution system. His distribution system does not stop at the city limits, but continues to the extent of the water lines. He should also recognize that he may be held personally liable for problems which may arise due to any unprotected cross-connection(s).

PRIVATE WELLS

Public drinking water supply systems must be protected from the possibility of contamination from private unapproved wells.

The mere existence of a private, unapproved well on property, which is supplied water through a public distribution system is grounds for some type of backflow prevention protection at the meter.

"Cross-Connection," as defined in the State Safe Drinking Water Act, "means any actual or potential connection or structural arrangement between a public water supply and any other source or system through which it is possible to introduce into any part of the potable system any used water, industrial fluid, gas or substance other than the intended potable water with which the system is supplied".

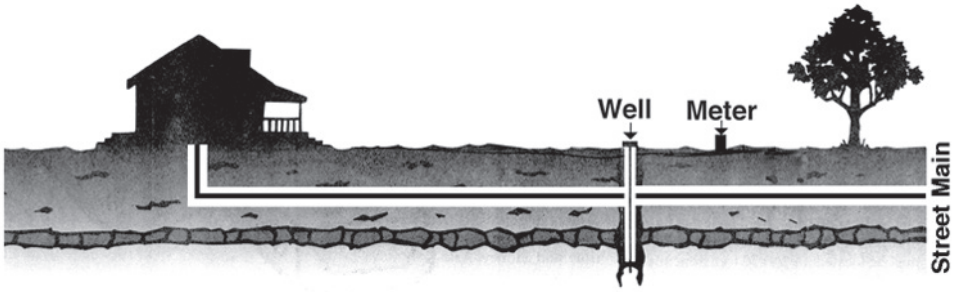
The word "potential" obviously refers to situations such as the "existence" of a private well which clearly has the potential of being tied into the public water supply through the facility's internal plumbing supply system.

The water purveyor does not have the time, manpower or legal clearance to snoop around private property in order to determine if a private well is interconnected to the public water system through the internal plumbing of that premise. This fact, coupled with his obligation to protect the public water supply from contamination, leaves the water purveyor with only two reasonable options.

1. Install a residential dual check at the service connection or meter. (In the case of an industrial or commercial account, especially where larger service lines exist, an approved double check valve assembly must be required or installed.)

2. Disconnect the public water supply from this premise.

Residential dual checks are made by several manufacturers. Some of the more common ones are: Watts # 7, Beeco-Hersey BSG, Wilkins # 700, Febco # 810, Mueller 14200-A, Conbraco 40-300, Ford HHA, HHS, HHCA.



AGRICULTURAL & COMMERCIAL FILL STATIONS

In many areas of our state potable water is used in suppling farmers, construction companies, and commercial sprayers with the water necessary for mixing with their pesticides, insecticides, herbicides, fertilizers, etc. This filling or mixing is usually done from a fire hydrant or a stand pipe. Since this can constitute a cross-connection between the potable water system and a toxic material, the potable water supply must be protected against the possibility of back siphonage.

If a fire hydrant is used for filling then an approved double check valve assembly or reduced pressure backflow prevention assembly must be attached to the fire hydrant.

However, if the filling is done through simple valve and fill line arrangement then one of the two procedures listed below are most commonly used and accepted around the state.

1. A properly installed air gap separation.

2. A properly installed atmospheric or pressure vacuum breaker.

The air gap is probably the least expensive and certainly provides the most positive protection. However, at least two problems have been encountered with the air gap method, which are:

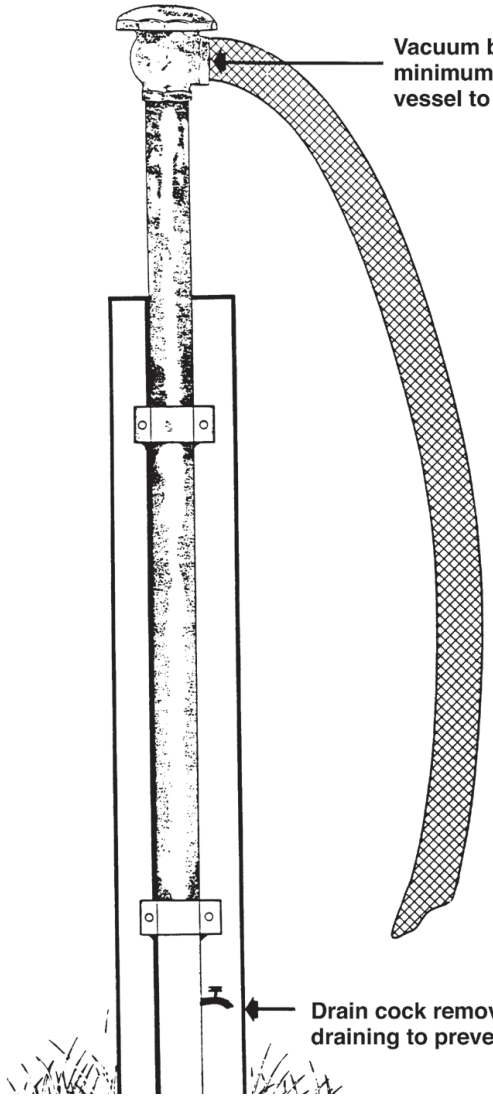
(a) If the outlet pipe of the air gap is reduced or if a lengthy hose is installed then water will spill out of the air gap. The water flow will have to be slowed considerably to compensate for this problem.

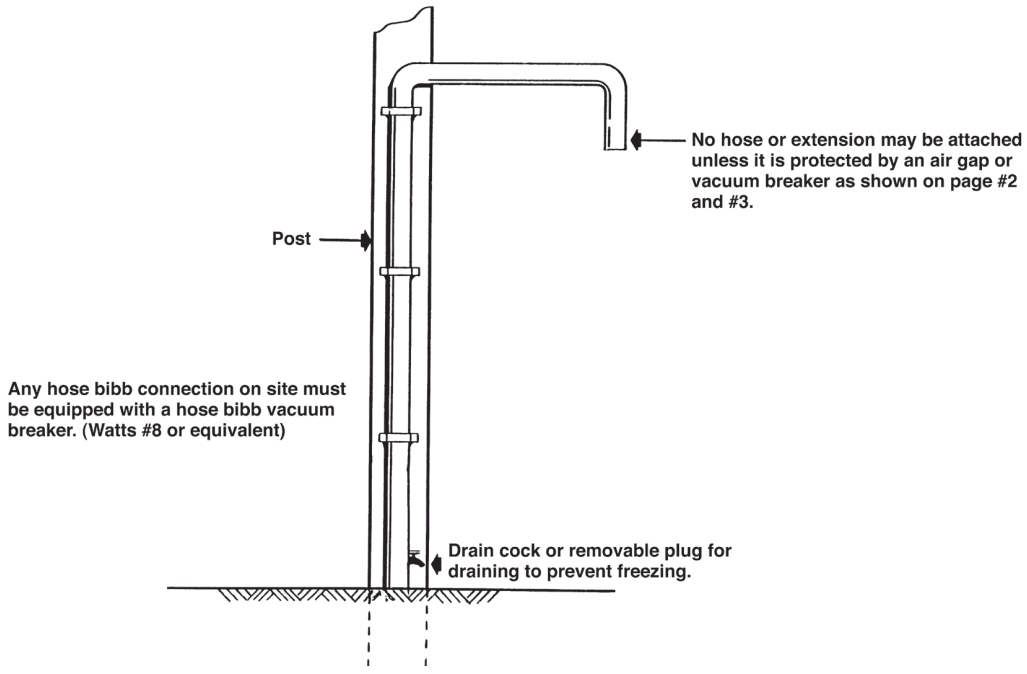
(b) If the air gap is installed immediately after an elbow the line the water will be in a state of turbulence at that point and again will spill out of the air gap. Again, reduction of flow may be necessary to compensate for this problem.

Mechanical Air Gap: Josam Model 1800 (or equivalent)
Atmospheric Vacuum Breaker: Watts 288-A (or equivalent)
Pressure Vacuum Breaker: Watts 800M4QT (or equivalent)

If additional information is needed on this subject please contact your water purveyor, the local DHEC Region Office, or call Mr. Steve Fox in Columbia at (803) 898-4426.

*(Illustrations on page 10)


Vacuum breaker must be positioned a minimum of 6" above the tallest tank or vessel to be filled.
No shut off valve is allowed on the discharge side of an atmospheric vacuum breaker. This line must remain open at all times.
Any hose bibb connection on site must be equipped with a hose bibb vacuum breaker. (watts #8 or equivalent)
Drain cock removable plug for draining to prevent freezing.


No hose or extension may be attached unless it is protected by an air gap or vacuum breaker as shown on page #2 and #3.
Post
Any hose bibb connection on site must be equipped with a hose bibb vacuum breaker. (Watts #8 or equivalent)
Drain cock or removable plug for draining to prevent freezing.

TYPES OF CROSS-CONNECTION CONTROL DEVICES

APPROVED AIR GAP SEPARATION

An approved air gap is a physical separation between the free flowing discharge end of a potable water supply pipeline and the top of an open or non-pressurized receiving vessel. The vertical, physical separation must be at least twice the diameter of the inlet pipe and never less than one inch. In theory, a well designed and properly maintained air gap is the best means available for protection against backflow. An approved air gap is not always practical for a number of reasons.

1. All system pressure is lost at the air gap.

2. Outlet pipes must be sized properly and not be too long or the water will flow out of the air gap resulting in the need to reduce the flow.

3. There cannot be an elbow immediately before the air gap or the water will be in a state of turbulence when it when it passes through the air gap, causing spillage.

In spite of the above mentioned drawbacks, the air gap offers the highest level of protection from backflow and may be necessary in some applications.

Air gaps should be inspected annually to insure that they have not been removed, by-passed, or tapped into on the supply side.

BAROMETRIC LOOP

A barometric loop is a piping arrangement which makes use of the principle that a perfect vacuum can only lift water vertically for 33.9 feet.

Barometric loops are only beneficial against backsiphonage and are not common in South Carolina. Most water purveyors would not offer approval for a barometric loop without additional mechanical protection at the meter.

MECHANICAL PROTECTIVE DEVICES

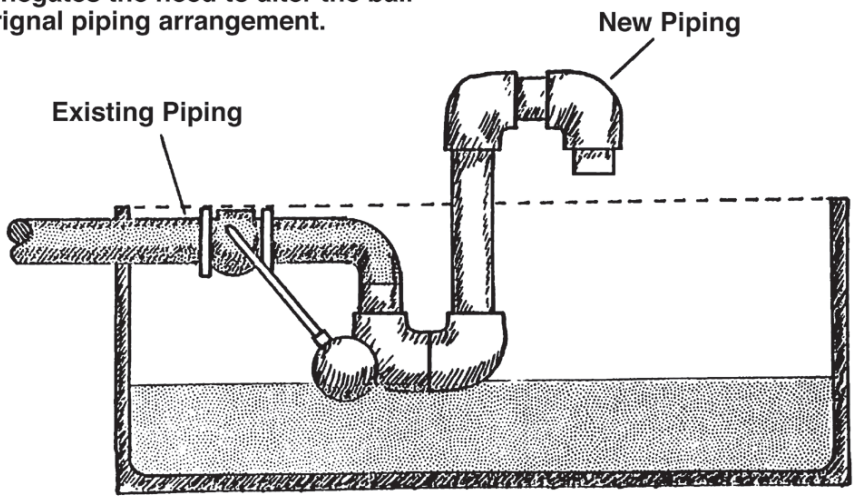
There are some seven (7) mechanical backflow prevention devices (not counting the air gap) which are used for various applications. They are: Reduced Pressure Backflow Preventers (RP), Double Check Valve Assembly (DCVA), Residential Dual Check, Dual Check With Vent, Atmospheric Vacuum Breaker (AVB), Pressure Vacuum Breaker (PVB), Hose Bibb Vacuum Breaker (HBVB).

Some of these devices (sometimes called “assemblies”) are designed for service connection application, while others are designed for internal protection (at the point of each offending fixture).

Following are pictures, as well as other pertinent information about each of the above listed devices or assemblies.

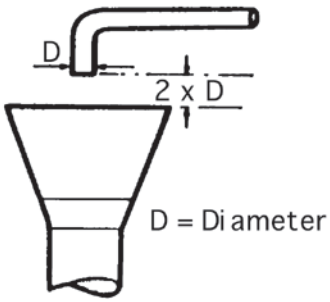
SUBMERGED INLET CONVERTED TO AIR GAP

An existing submerged inlet can often be converted to an approved air gap simply by adding some additional piping. This approach negates the need to alter the ball cock or orignal piping arrangement.

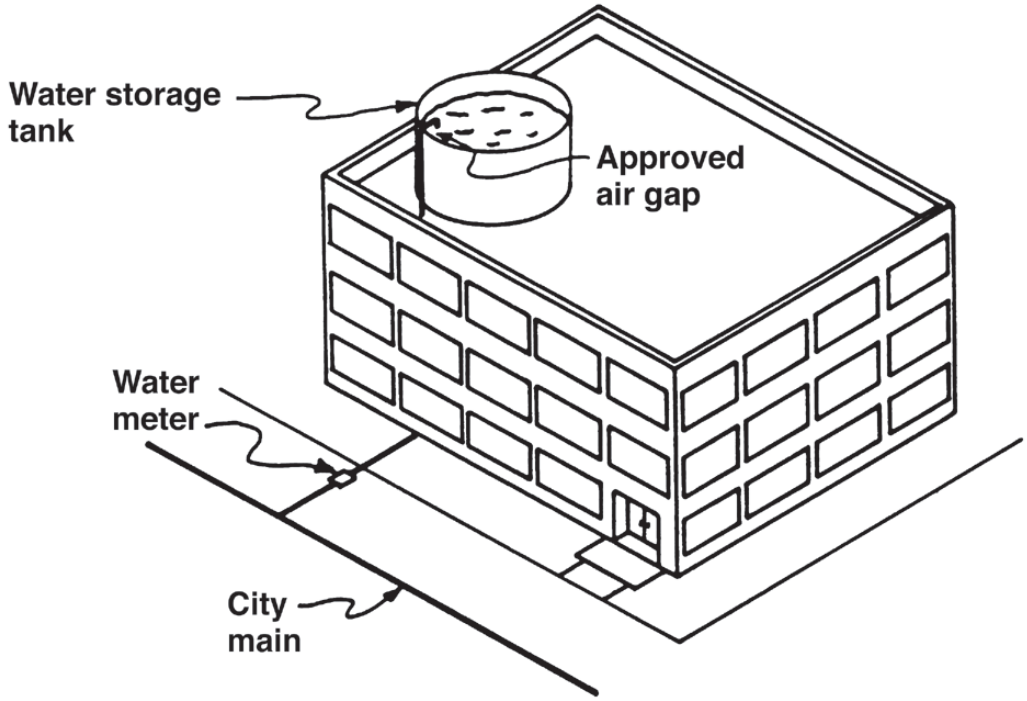


Air gaps must be measured between the supply pipe and the flood level rim of the receiving vessel, and not between the supply pipe and water level or overflow. The only constant or positive overflow is the flood level rim.

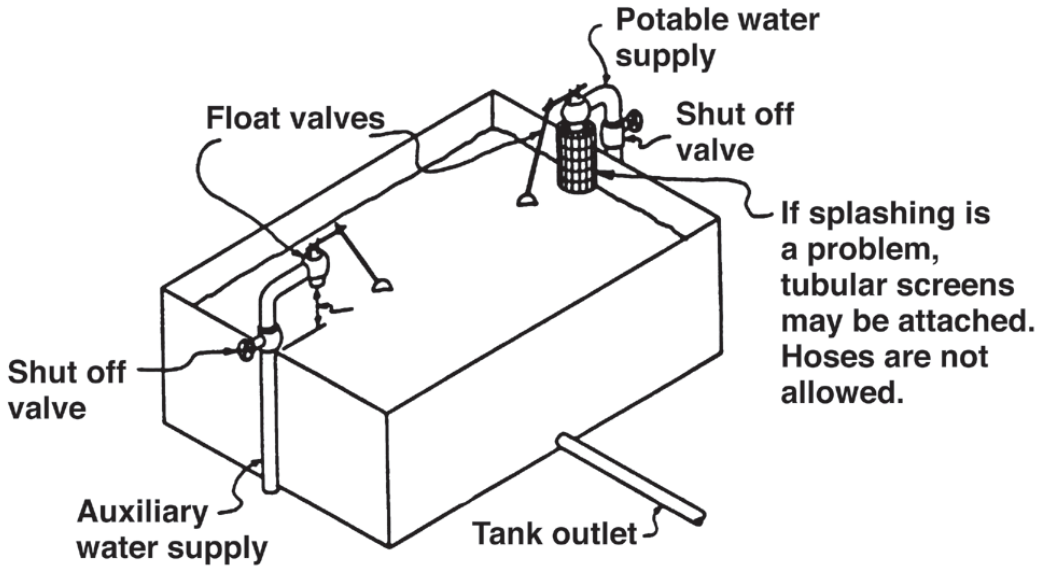
The vertical distance between the supply pipe and the receiving vessel must be at least twice that of the diameter of the supply pipe.



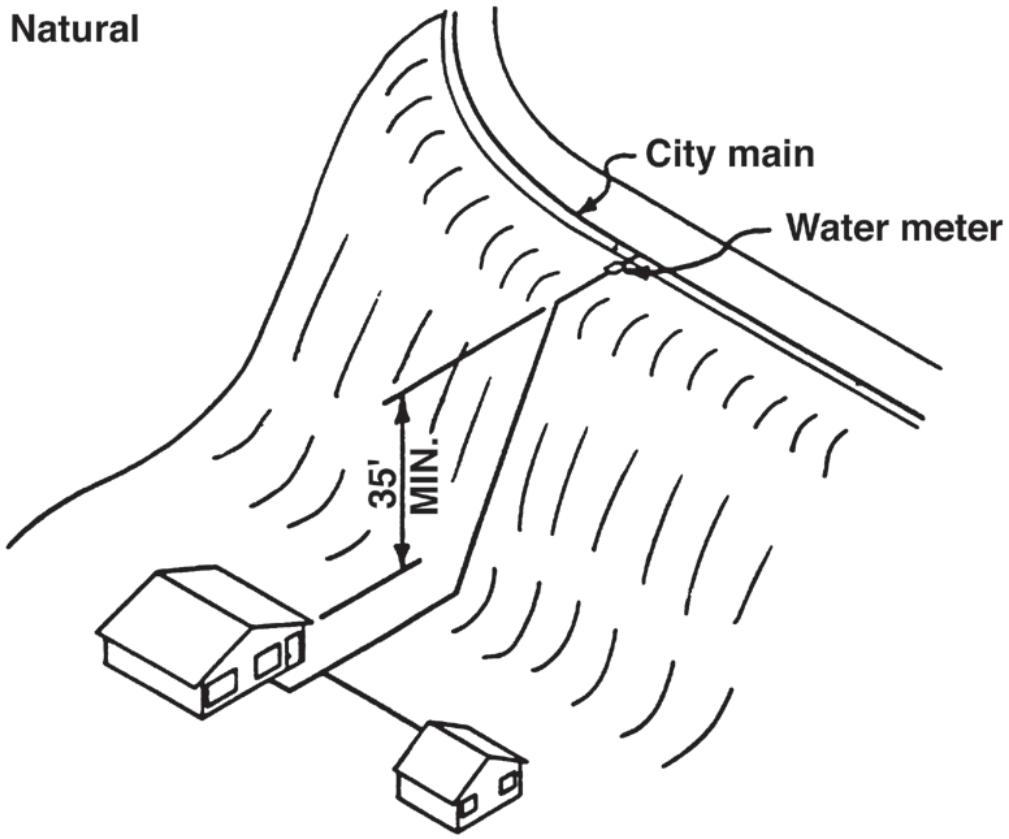
LARGE BUILDING WITH AIR GAP AT WATER STORAGE TANK

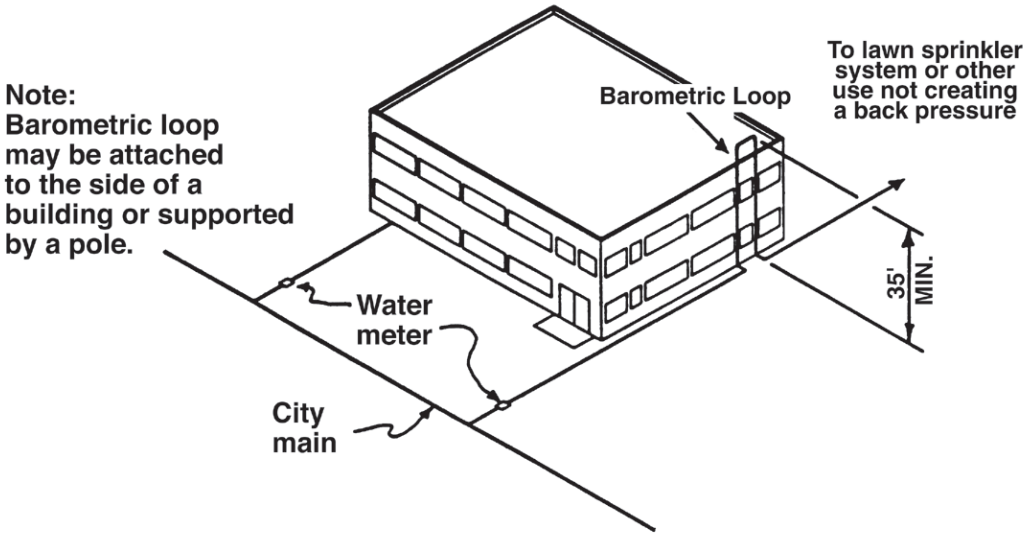


AIR GAP AT MAKEUP TANK FOR A DUAL WATER SYSTEM



TYPICAL INSTALLATIONS OF A BAROMETRIC LOOP
(ILLEGAL IN SOME JURISDICTIONS)





1. Reduced Pressure Principle Back low Prevention Assembly

The Reduced Pressure Principle Backflow Prevention Assembly consists of two independently acting, internally loaded, approved check valves, separated by a reduced pressure zone. This device must be installed as a unit. This means that all test cocks and gate or ball valves must be in place and properly located when installed. Due to the strength of the first check valve spring, the pressure in the zone between the two check valves is maintained at a lower pressure than supply pressure. The pressure in the zone must never come any closer than 2 psi to supply pressure. Detailed operation of this device is covered extensively at the SCDHEC Cross-Connection Control and Certification Training.

The RP is approved for installation on either back-pressure or back-siphonage backflow. It is also approved for high hazard category cross-connections, and may be substituted for an air gap in most jurisdictions.

INSTALLATION

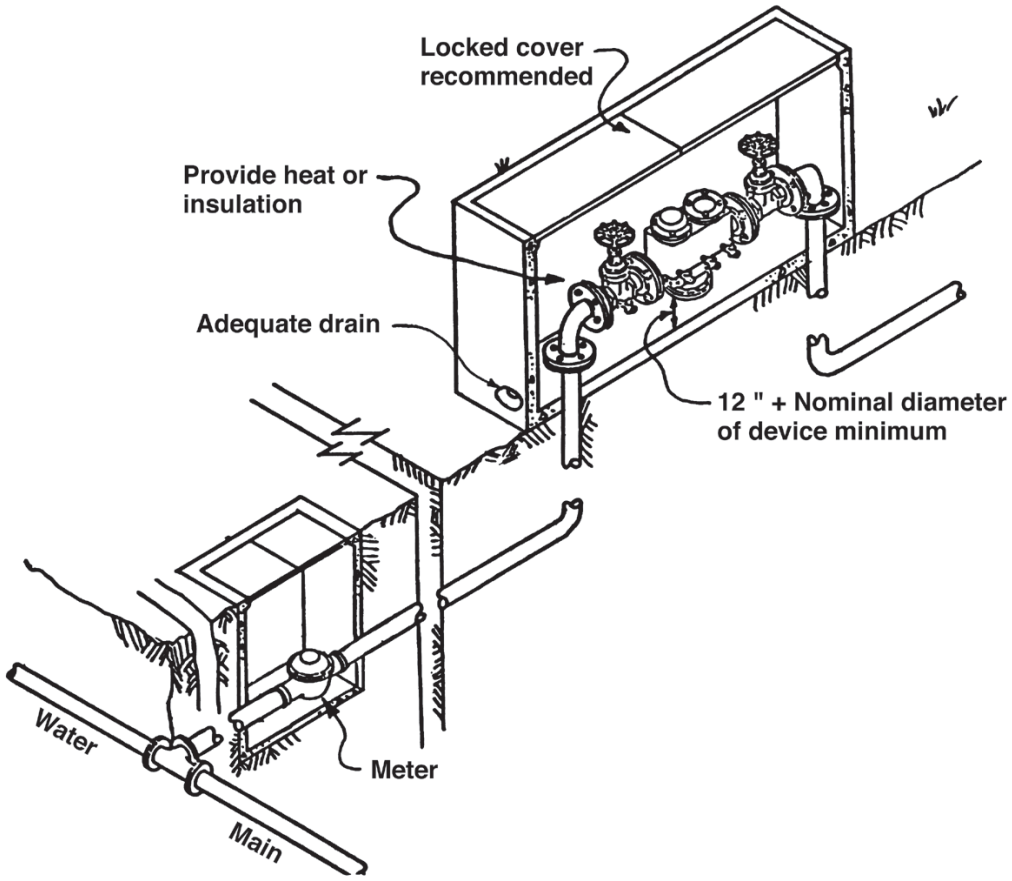
A. The RP should be installed with adequate space to facilitate maintenance and testing. A working space of 12 inches, plus the nominal size of the device, must be allowed on all sides of the device. This is necessary for hand tool space as well as removal of some springs, checks, etc.

B. An RP should be inspected and tested upon installation in order to insure its proper installation operation. The S.C. State Safe Drinking Water Act requires these devices to be tested upon installation and once annually after that.

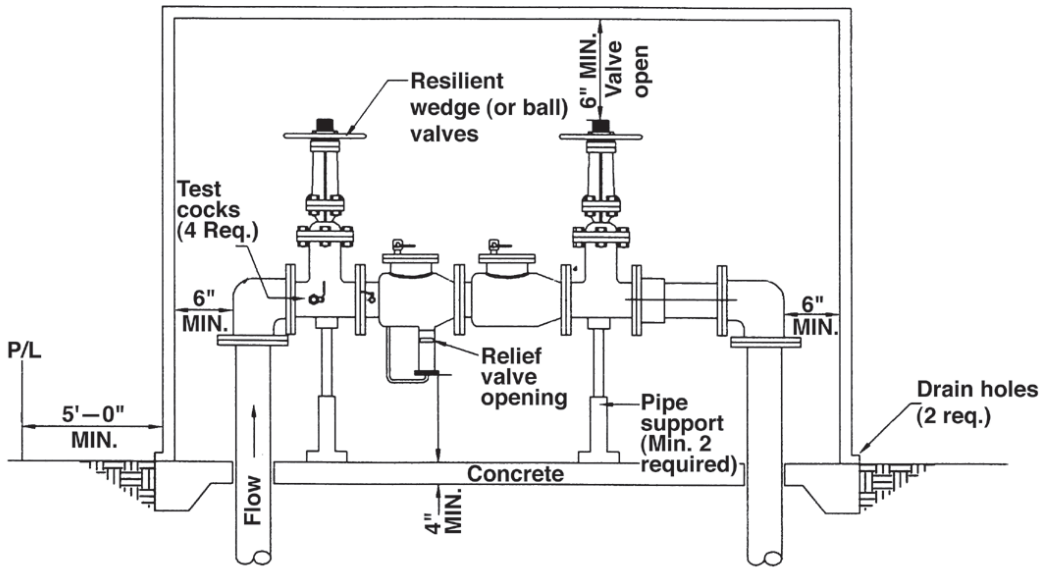
C. An RP cannot be installed in a pit below ground level unless the pit or vault is drained to the surface of the ground by gravity. This drain cannot be emptied into any type of ditch, storm drain, or sewer which could flood water back into the pit. The drain must be large enough to accommodate the flow of the relief valve at full dump. Even when RP's are installed inside of the facility, there must be some method of piping the relief or dump valve water away to an adequate drain, i.e., a floor drain or through-the-wall drain. Any drain used on the RP must be protected by an adequate air gap.

D. The RP device must be protected from freezing if applicable. There are several different ways to accomplish this. Insulating is often effective. There are several companies which manufacture insulated fiberglass or metal enclosures. These are good because they save the cost of a pit and they keep the RP above the ground for greater ease of testing and repair. If electrical power is readily available the heat stripping or heaters may be used as well.

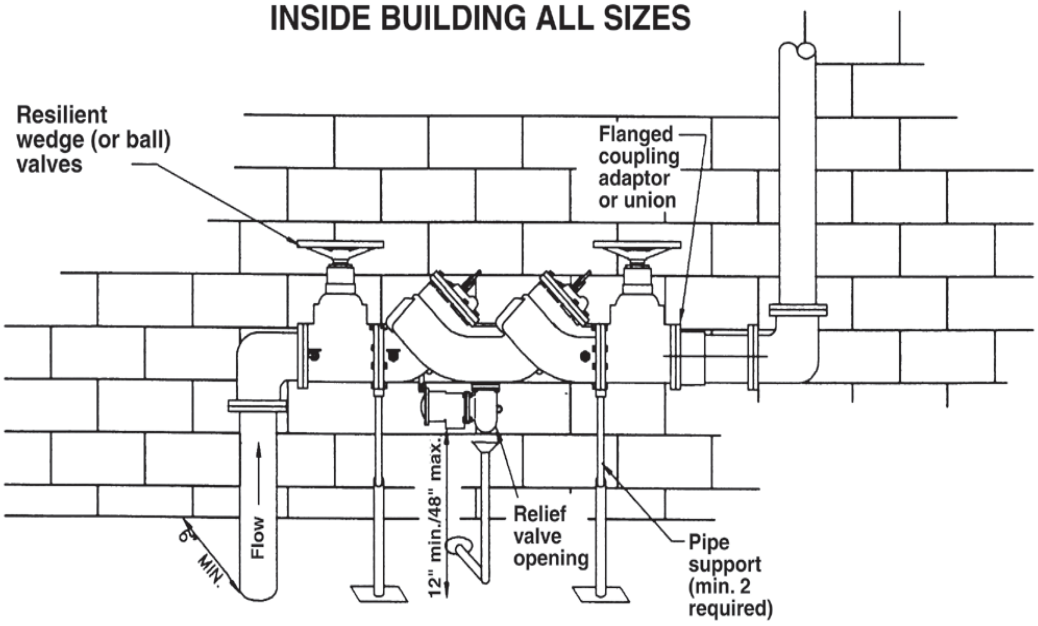
TYPICAL INSTALLATION OF REDUCED PRESSURE PRINCIPLE DEVICE



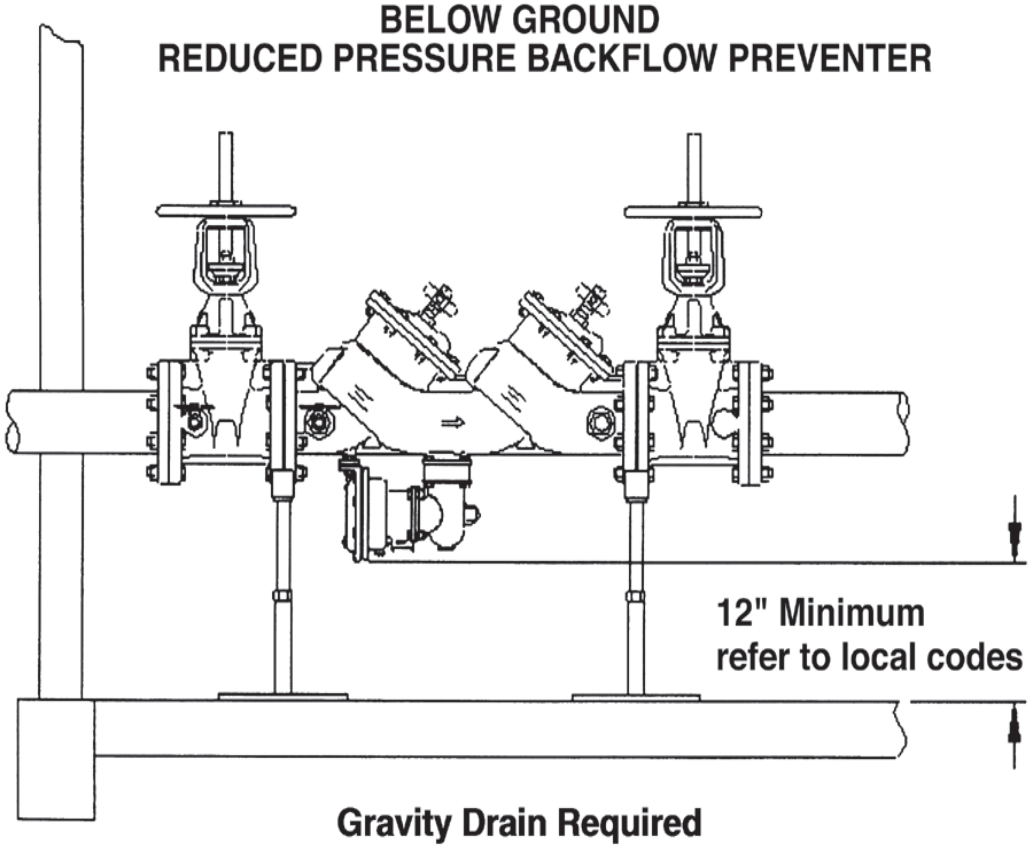
REDUCED PRESSURE PRINCIPLE ASSEMBLY ABOVE GROUND ENCLOSURE ALL SIZES, ALSO ENCLOSURE CAN BE USED FOR DOUBLE CHECK VALVE ASSEMBLY



REDUCED PRESSURE ASSEMBLY
OR DOUBLE CHECK VALVE ASSEMBLY
INSIDE BUILDING ALL SIZES



BELOW GROUND
REDUCED PRESSURE BACKFLOW PREVENTER



E. If the RP is installed on a hot water line then a special hot water model must be ordered for this application. Of course, this would only apply to internal applications.

F. The assembly must be sized properly in order to accommodate the desired flow. If a facility must have water service on an uninterrupted basis then two or more RP's will be necessary in order for one to be shut down for maintenance, testing or repair. In sizing the RP, if only one assembly is used per line then a smaller than line size assembly must never be used. However, if a by-pass installation is used then the by-pass assembly may be sized smaller than the size of the supply line in question. When installing assemblies in parallel both assemblies must be same size for continuous service. Remember to always study the flow and pressure curves from the manufacturer of the RP in order to make the proper decision.

G. Always flush lines before installation of the assembly

2. Double Check Valve Assemblies

This assembly consists of two internally loaded approved check valves, four properly located test cocks, and two tightly closing shut off valves. Weight loaded check valves (formerly used on fire lines) are no longer manufactured. This means that all new, approved DCVA's will be spring loaded. DCVA's are approved for non-health hazard applications only.

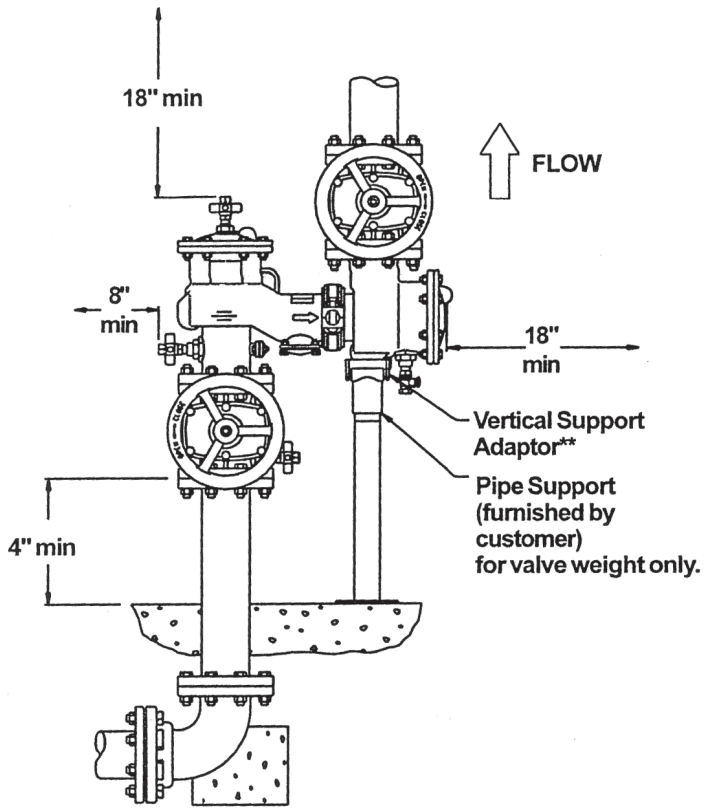
INSTALLATION

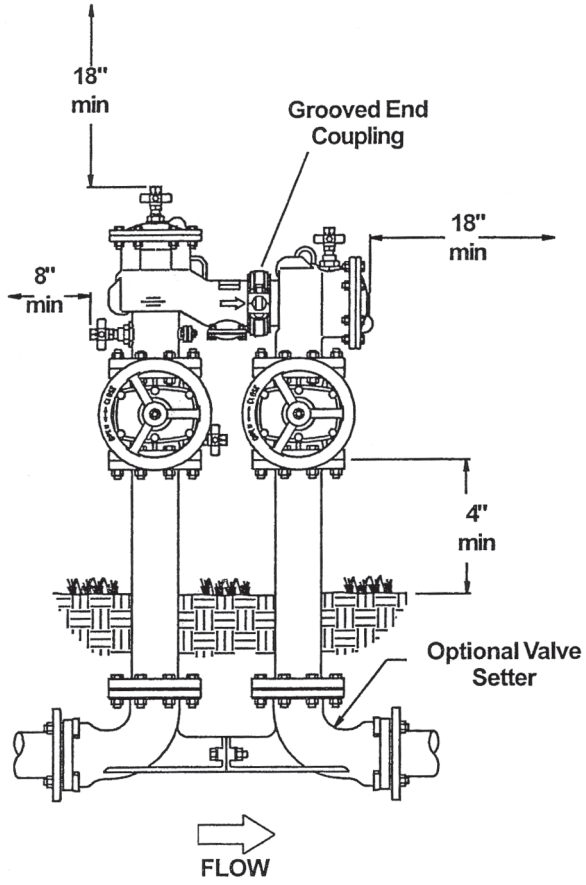
1. A DCVA should be installed with adequate space to facilitate maintenance and testing. As with the RP, a space of 12" plus nominal size of the DCVA should be allowed on all sides for maintenance, testing, and repair.

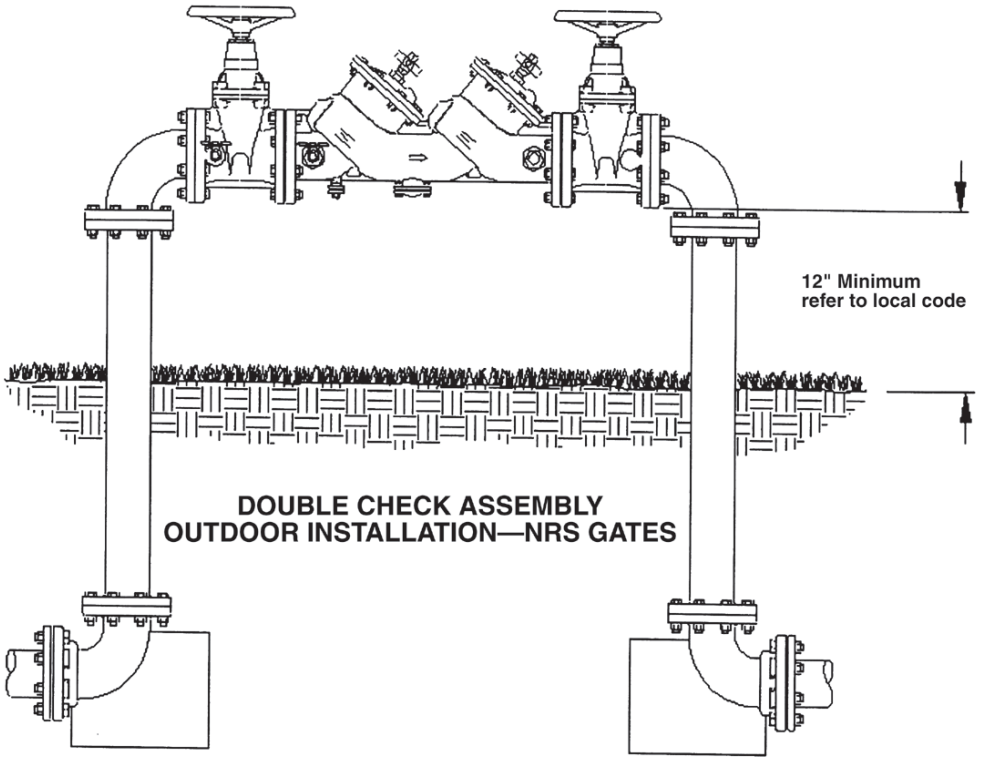
2. DCVA's are required to be tested after installation and once annually after that by the State Primary Drinking Water Regulations. These tests are required to be performed by a DHEC certified tester.

3. Pit installations of DCVA's are allowed in S. C. unless prohibited by local codes. However, good engineering practices would dictate that the pit should not be allowed to remain full of water. Testing and repair of any equipment are greatly impaired by the inability to access that equipment. Also, when DCVA is submerged under water and subjected to a negative pressure the possibility of an external leak on one of the shutoff valves or test cocks may allow contamination of this system to occur.

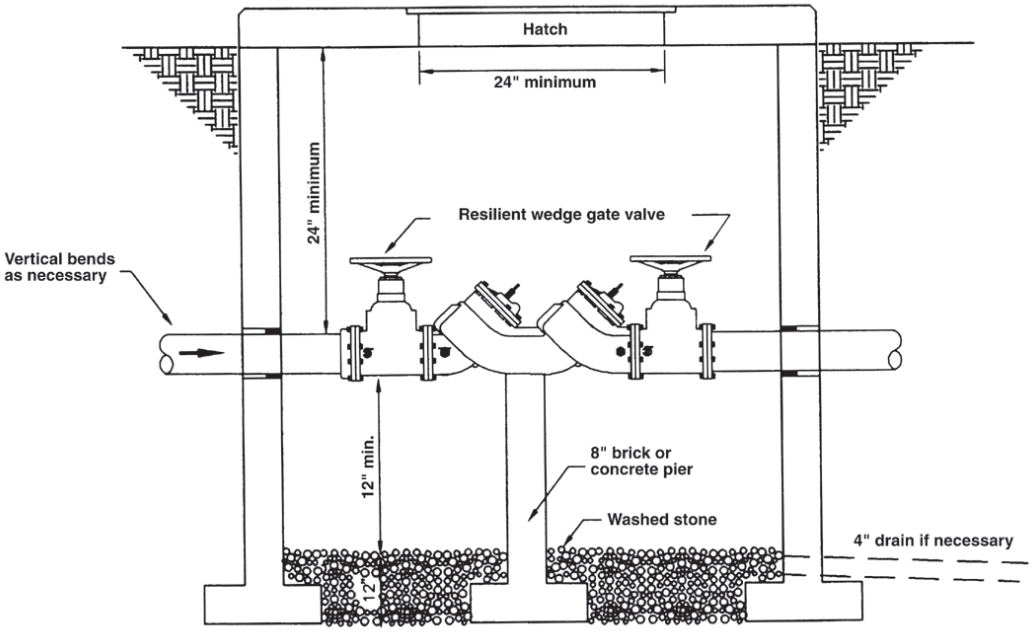
4. Thoroughly flush the lines prior to installing a DCVA


18" min
FLOW
8" min
18" min
Vertical Support Adaptor**
Pipe Support (furnished by customer) for valve weight only.
4" min


18" min
Grooved End Coupling
18" min
8" min
4" min
Optional Valve Setter
FLOW

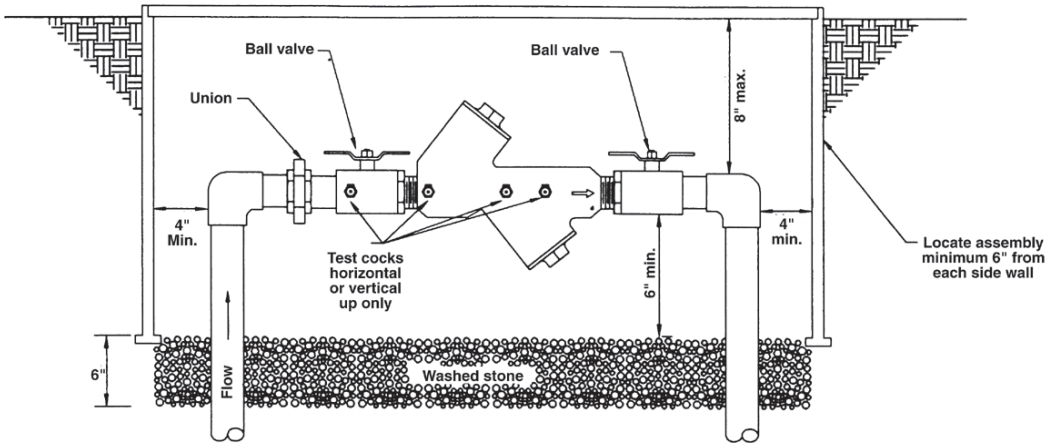


DOUBLE CHECK ASSEMBLY
OUTDOOR INSTALLATION—NRS GATES



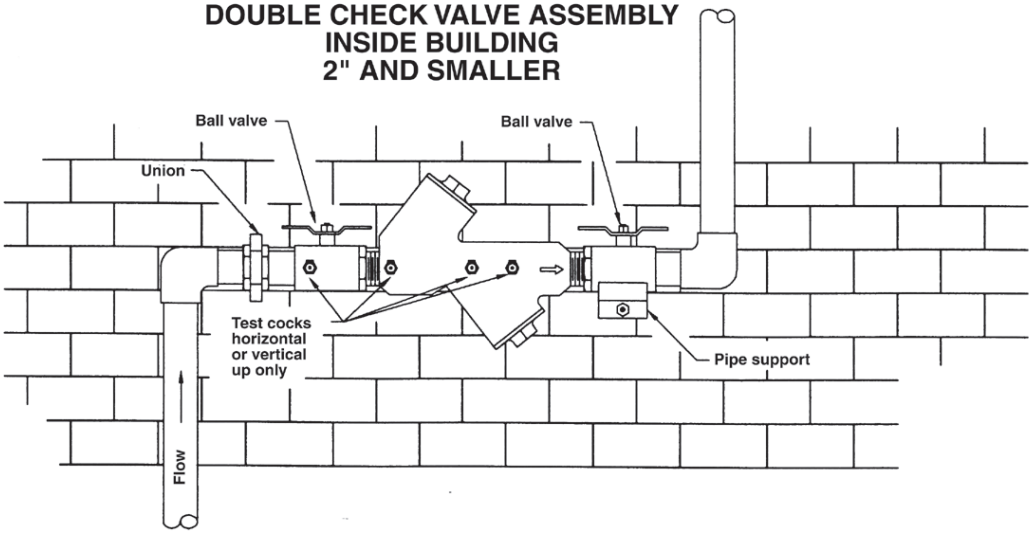
Notes:
* Walls may be precast concrete, reinforced poured in place concrete, filled block or brick.
* Top may be reinforced concrete, reinforced poured in place concrete, steel plate with epoxy coating, or alinum plate.
* Hatch shall be manufactured steel or aluminum door, cast iron manhole ring and cover equal to sumter machine MF-11 frame and MF-18 cover, or fabricated steel or alminum opening suitable to owner.
* Wall sleeves P.V.C., cast iron, steel or core drilled concrete.

DOUBLE CHECK VALVE ASSEMBLY
BELOW GROUND VAULT
2" AND SMALLER



Notes:
Box shall be constructed at owners discression of suitable material with removable access cover capable of handling traffic load that it may be subject. Also it shall be vandal resistant and provide protection from weather elements.

DOUBLE CHECK VALVE ASSEMBLY
INSIDE BUILDING
2" AND SMALLER



Note:
Assembly to be a minimum of 6" from wall and 12" (min.) off floor.

3. Vacuum Breakers

In line vacuum breakers are commonly broken into two different categories: Atmospheric and Pressure type. Both types are only approved for backsiphonage applications, and cannot be installed where backpressure is a possibility. Other installation and application restrictions are listed below.

PRESSURE VACUUM BREAKER

Pressure Vacuum Breakers are only approved for backsiphonage backflow and must be installed a minimum of 12" above the highest outlet or any downstream piping /use. Pressure Vacuum Breakers come equipped with a shut-off valve on the outlet side of the device. This means that the Pressure Vacuum Breaker can be installed in continuous pressure applications (with shut-off valves on the outlet side of the device). The existence of a small spring installed on the atmospheric side of the air inlet valve enables the Pressure Vacuum Breaker to be installed under continuous pressure. The atmospheric vacuum breaker does not have this spring and cannot operate under continuous pressure.

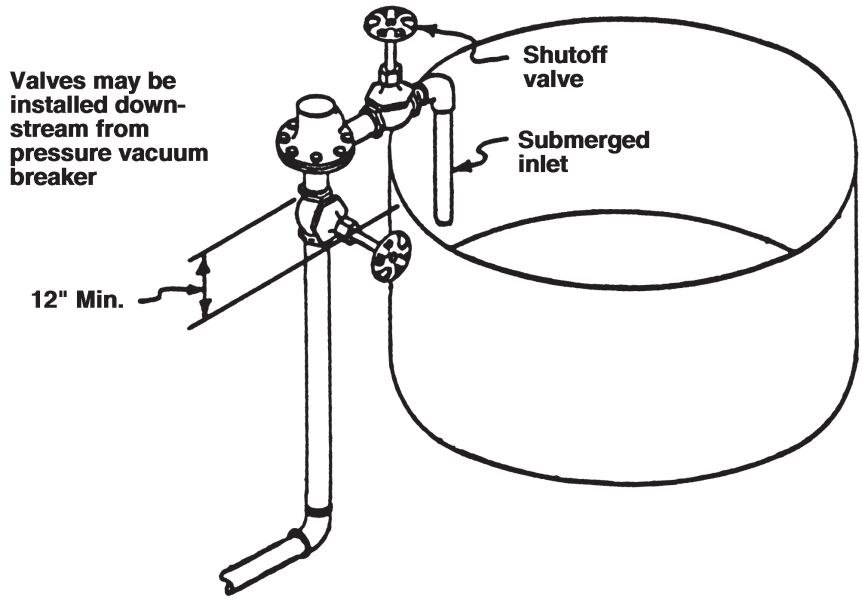
ATMOSPHERIC VACUUM BREAKER

Atmospheric Vacuum Breakers are only approved for backsiphonage backflow and must be installed a minimum of 6" above the highest outlet or any downstream piping /use. Atmospheric Vacuum Breakers are not equipped with a shut-off valve on the outlet side of the device and cannot be installed under continuous pressure (no shut-off/control valves allowed on the outlet side). Specifications restrict the Atmospheric Vacuum Breaker from being installed where it will operate under continuous pressure for more than 12 hours at a time. Atmospheric Vacuum Breakers must be installed in the vertical position.

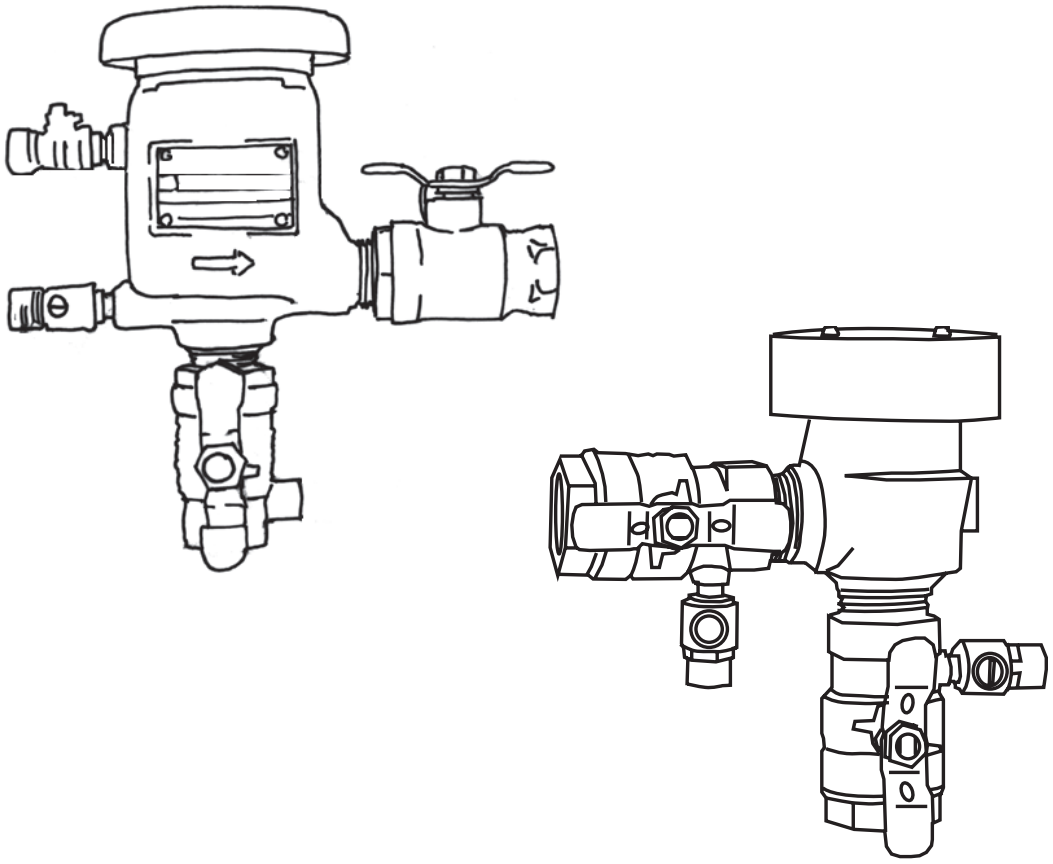
HOSE BIBB VACUUM BREAKERS

Hose Bibb Vacuum Breakers are designed to screw onto the threaded end of a spigot. They are actually a check valve and a vacuum breaker all uniquely designed to operate in a very small space. Hose Bibb Vacuum Breakers are not designed to be installed in any location which may be subject to flooding. However, they may be installed below the hazard they are protecting, and are approved to accept a low level of backpressure, but only that which would occur from the hose being lift higher than the spigot. Be mindful that a Hose Bibb Vacuum Breaker may cause a spigot to be more susceptible to freezing since it restricts the ability of the spigot to drain freely. Some spigots are designed to resist freezing. These spigots are called frost proof spigots. They must be equipped with special Hose Bibb Vacuum Breakers in order to operate properly.

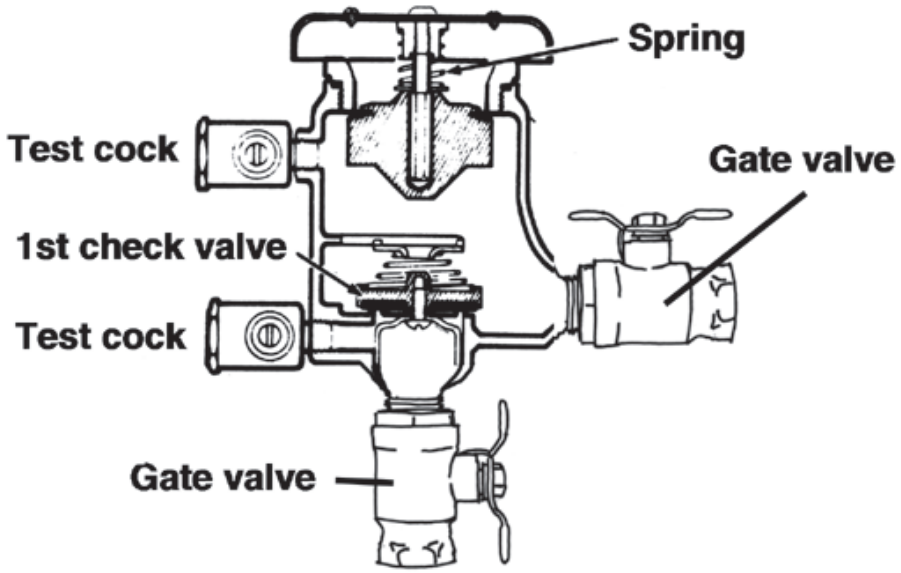
PRESSURE VACUUM BREAKER



PRESSURE VACUUM BREAKERS

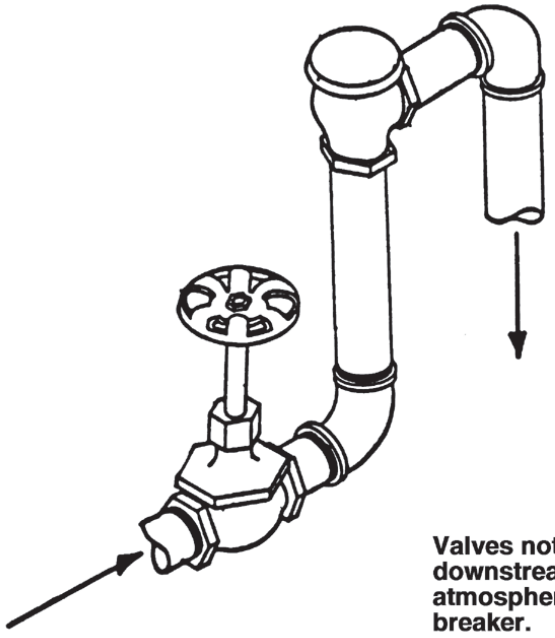


PRESSURE VACUUM BREAKER

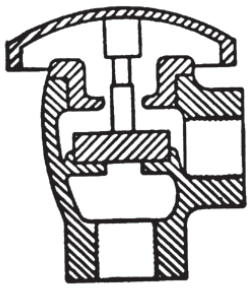


3/4 inch—2 inches

ATMOSPHERIC VACUUM BREAKER

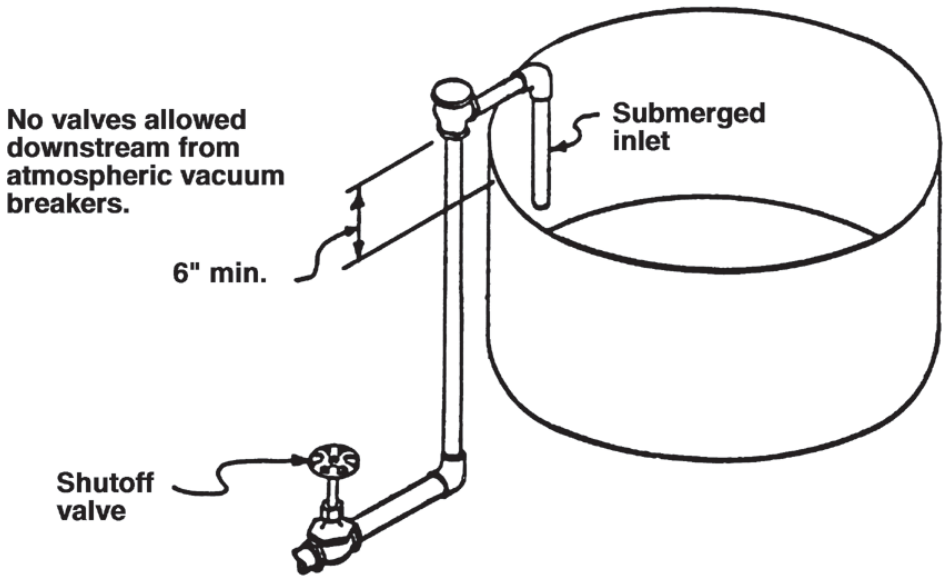


Valves not allowed downstream from atmospheric vacuum breaker.



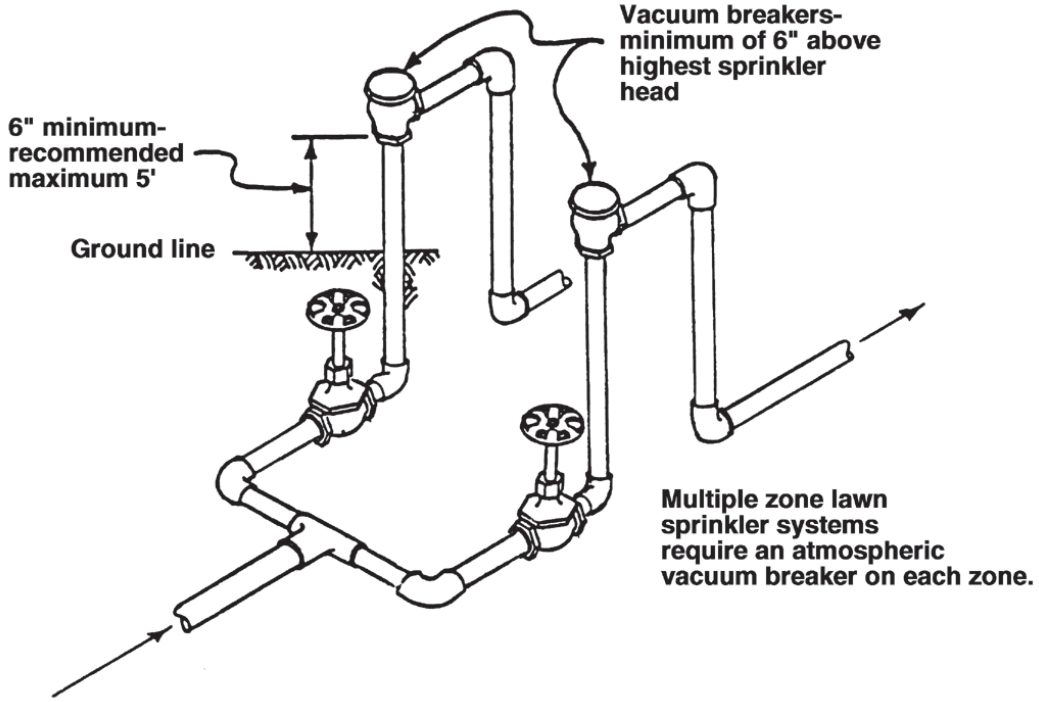
Vacuum breaker cross section (shown open to atmosphere)

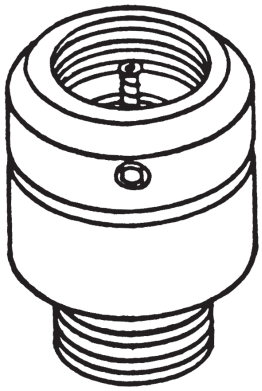
ATMOSPHERIC VACUUM BREAKER

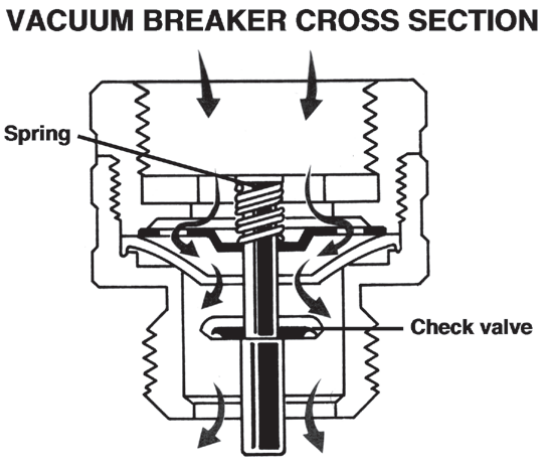


TYPICAL INSTALLATIONS OF ATMOSPHERIC VACUUM BREAKERS

Sprinkler System Application

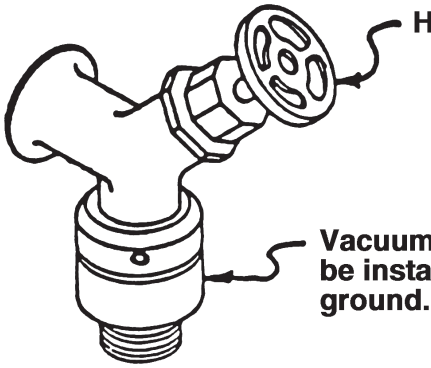






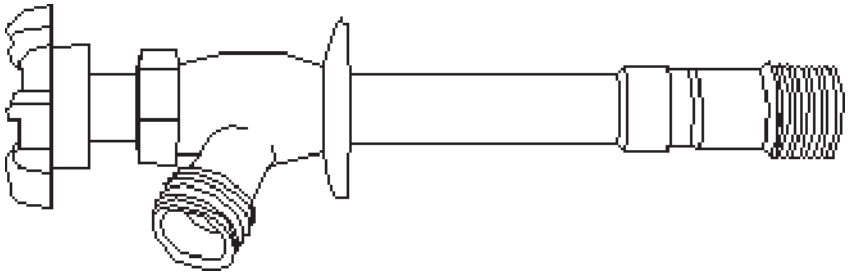
Hose Bibb Application

Caution
Do not use on frost free hose bibbs unless the vacuum breaker can be drained.



Hose bibb vacuum breakers are not designed for more than 12 hours of continuous use, nor is it approved to have down stream shut off valves. Violation of either of these conditions will invalidate the accreditation of the hose bibb vacuum breaker approval.

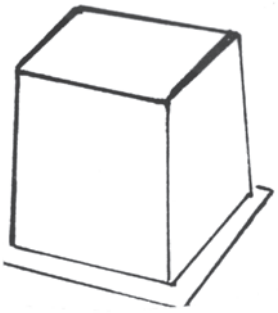
Freeze Proof Spigot

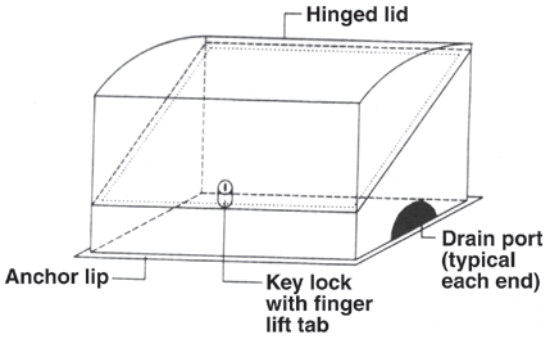


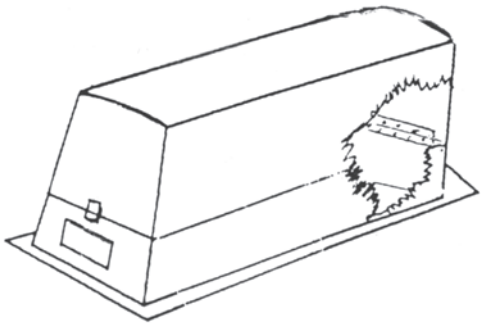
ENCLOSURES

Due to the passage of the OSHA regulations on confined spaces, the acceptability and popularity of above ground installations of backflow prevention devices continues to increase. A number of companies have risen to the occasion and are currently marketing some very attractive and durable above ground enclosures. Some are insulated while others are insulated with optional heaters. It is important that the enclosure be approved under the ASSE standard 1060. This will insure the ability of the enclosure to drain properly in the event of a full dump situation. The standard also insures freeze protection according to the label, and provides other quality controls.

It is important to make decisions during the design phase, or during the construction phase, at the latest, as to where and how the backflow prevention assemblies are to be installed. Consideration must always be given to the possibility of freezing when above ground installations are chosen. Enclosures which are approved under ASSE 1060 will prevent freezing, allow easy access for testing and repair, and will eliminate the worry over confined spaces regulations.







RESIDENTIAL DUAL CHECKS

Residential dual checks consist of two independently operating spring loaded check valves, no test cocks, and no shut-off valves. These devices are not required by any DHEC regulation to be tested annually. However, DHEC does recommend that Dual Checks be removed at least every time the meter is removed and replaced. Some systems have a replacement schedule which calls for the removal and replacement of a percentage of the Dual Checks in that system on a periodic basis.

Residential dual checks belong to a family of devices which were initially designed to be installed on or near the service connection meter of residences. They are not meant to be the only method of backflow prevention used to address residential problems, but are meant to supplement a program of hose bibb vacuum breakers, as well as other specialty equipment devices which may exist within the private residence.

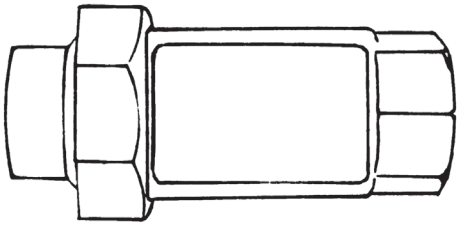
Now, however, Residential Dual Checks are finding their way into a variety of applications. Some systems install or require them on all new small taps. A special edition is even marketed by one manufacturer which is designed to be installed on a hose bibb, in place of or in addition to a hose bibb vacuum breaker. A special 3/8" size is available in stainless steel and bronze which will handle hot water up to 180 degrees. Some companies are manufacturing these devices in 2" sizes for low hazard applications such as apartment complexes.

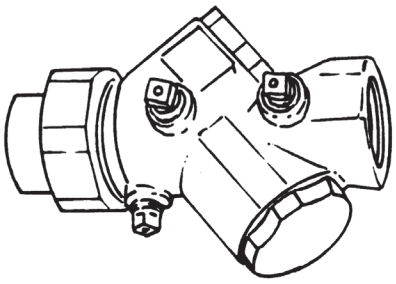
The only standard of approval which is written for Residential Dual Checks is ASSE 1024. Currently, sizes larger than 1" are not approved under this standard because the ASSE standard 1024 does not address Dual Checks in sizes larger than 1". The Foundation for Cross-Connection Control and Hydraulic Research in California does not offer an approval for the Residential Dual Check. Therefore, many states which look to USC for leadership do not even acknowledge the Residential Dual Check as being a credible member of the backflow prevention family of devices, and do not promote or acknowledge the installation of this device on their systems.

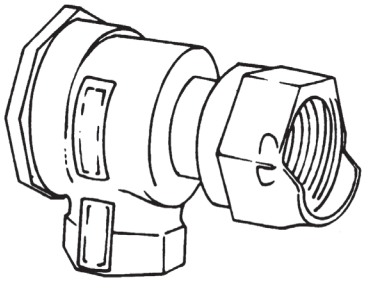
There has been some confusion about the fact that the residential dual check is not listed on the DHEC List of Approved Devices. This is only because DHEC does not address Dual Checks on the Approval List.

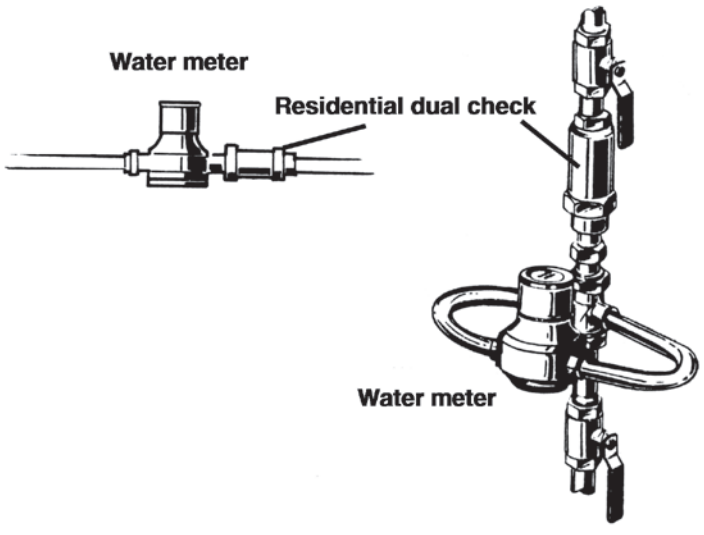
South Carolina DHEC endorses the use of residential dual checks on residences, (especially on rural water supply systems where private wells are a likelihood), as well as on all 3/4" service connections, such as strip mall shops, small offices, small restaurants, etc. This does not mean that there will not be additional protection provided or required within these facilities.

DHEC STRONGLY urges every water utility to adopt a program of residential containment by installing the residential dual checks at each service connection. The State Primary Drinking Water Regulations require that cross-connections be located and eliminated. Since the water purveyor does not have the time, manpower, or authority to trespass on private property looking for potentially dangerous cross-connections, the installation of some credible device at the service connection meter is the only acceptable method of accomplishing this. Entering the customer's property and performing labor intensive and unauthorized inspections is out of the question.









DUAL CHECK WITH INTERMEDIATE ATMOSPHERIC VENT

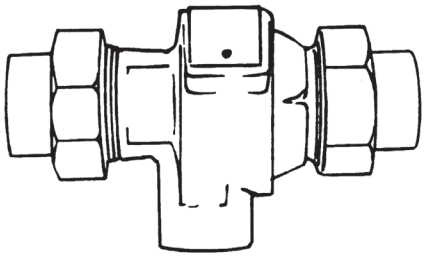
The device pictured below is called by several different names; however, it is important to understand that it is not a reduced pressure backflow preventer. While it does have an atmospheric vent, this is not the same thing as a differential relief valve.

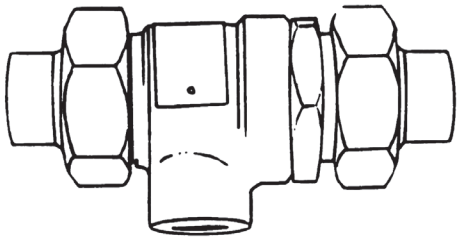
The Dual Check With Intermediate Atmospheric Vent is approved under ASSE 1012, and is offered in 3/4" sizes only. It is approved for use on applications where low to intermediate hazards are suspected, and is designed and approved for use where backsiphonage and backpressure are present.

This device is frequently used on in-line applications such as small untreated boiler water make-up lines, commercial kitchen steamers, animal watering troughs (where automatic watering devices exist), etc.

The pressure loss through the Dual Check With Intermediate Atmospheric Vent is significant. Manufacturers' flow/head loss charts should be consulted for specific information. These devices are not required to be tested by a certified tester; however, a visual check is advisable to check for leakage. If leakage occurs consistently from the vent then the device should be rebuilt or replaced.

Always be sure to follow the manufacturers' instructions for installation. The Dual Check With Intermediate Atmospheric Vent is normally approved for vertical and horizontal installations, but should never be chosen as a replacement for the Residential Dual Check and installed at a service connection meter. However, the vent must be positioned so that water can flow freely out to atmosphere. This device may be installed below what it protects, but may not be installed in a meter box or some other location which is subject possible flooding. This device is not designed to be installed at the service connection meter to a residence or business.





RECOMMENDED BACKFLOW PREVENTION PROCEDURES

In determining the degree of hazard and the type of backflow prevention device/assembly to require or install, several things must be considered. Whenever possible, the type of backflow prevention device/assembly should be commensurate with the degree of hazard in question. The Reduced Pressure Backflow Preventer and Air Gap are the only two BFP's which are approved for a clear high hazard. In making these determinations, it is important to remember that there are devices which are specifically designed for internal protection applications and others which are suitable for both internal and containment applications.

It is the responsibility of the water purveyor or cross-connection control program manager to be personally involved in the decision making process as to which type of backflow preventer should be installed under the containment approach. However, internal protection application decisions may be made by qualified plumbers or contractors, with the involvement of the local plumbing inspection division personnel.

A high degree of hazard is one which could cause injury to the health of the individual or damage to the water system. Generally speaking, an individual's health or life would be potentially threatened under a high hazard category cross-connection. Whereas, a low hazard category cross-connection would not cause damage to the health or distribution system. It may often show up as discolored water which may be aesthetically objectionable, i.e., look bad, taste bad, smell bad, etc., but not cause illness other than anxiety. In determining the degree of hazard, several parameters must be considered. They are:

1. Degree of hazard. Toxic or non-toxic.

2. Backsiphonage and backpressure, or simply backsiphonage. (Even though the substance in question may be considered toxic, but not highly toxic, the degree of hazard can be considered less or down graded slightly because there is no backpressure threat). Atmospheric or Pressure Vacuum Breakers and Dual Checks With Atmospheric Vent are often prescribed for protection against what would be considered to be a high hazard, but offers no backpressure possibilities. When backsiphonage possibility only is offered the degree of hazard is lessened considerably.

3. The approach of the municipality or water purveyor in question. Some programs are more aggressive than others, and while it is required that the State Primary Drinking Water Regulations be complied with, some water supply systems have local regulations and ordinances which give the the authority to enforce a more rigid program.

CONTAINMENT OR PREMISE ISOLATION vs. ISOLATION OR INTERNAL PROTECTION

Generally speaking, Premise Isolation or Containment refers to the policy or approach of requiring or installing the backflow prevention assembly or device at or very near the service connection meter. The Containment approach is a very popular one among water purveyors because it allows them to be exempt from the responsibility of what might occur within the facility, while offering very good protection to the public water supply system.

The Isolation or Internal Protection approach is one which requires a complete internal inspection of the facility and the appropriate type of backflow protection prescribed and installed at each offending fixture/outlet. If this approach is successful then the facility personnel, as well as the public water supply system are protected. However, since this approach requires risk, training, and additional effort and time on the part of the water purveyor, it is often shunned by that office and considered impractical.

A well rounded cross-connection control program is one which is a blend of the two approaches. If the facility owner is diligent in locating and eliminating the potential and actual cross-connections within the facility and maintaining open communication between his office and that of the water purveyor then the level of protection required at the service connection meter by the water purveyor can often be down graded from an R.P. to a D.C.V.A. The ability to do this will save money and allow additional pressure within the complex.

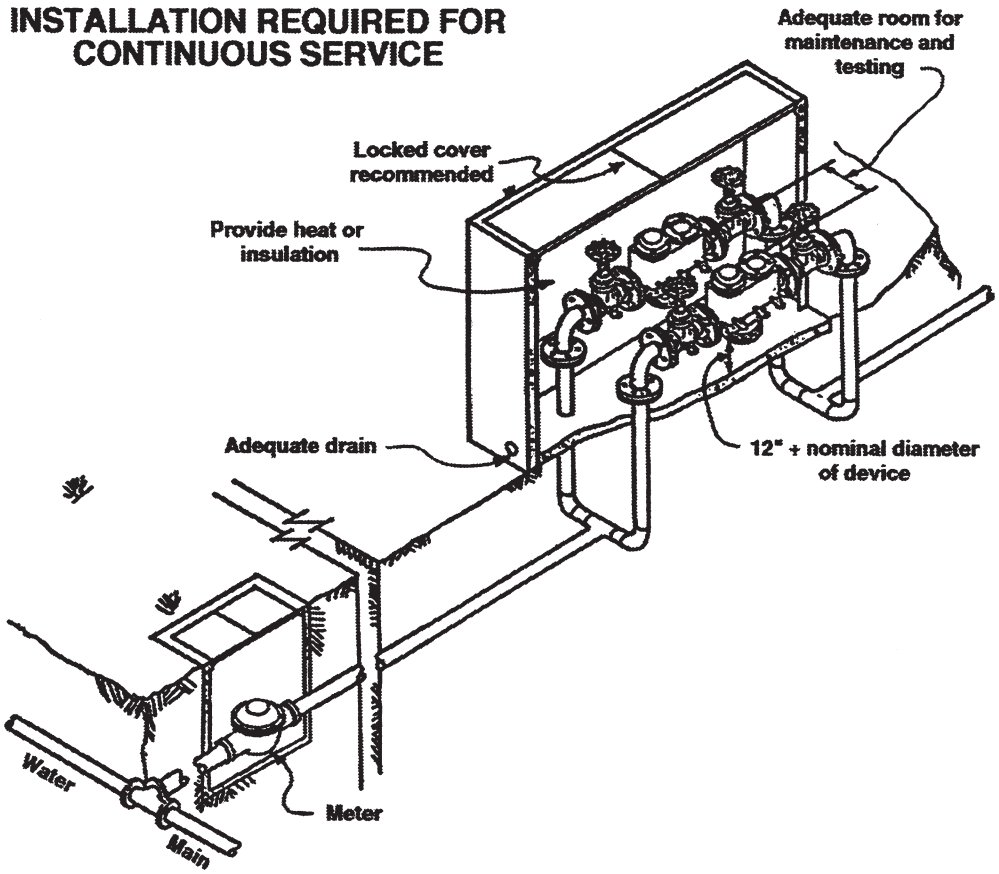
FLUSHOMETER VALVES

Multi-story buildings which have a number of flushometer toilets should be equipped with parallel assemblies. Experience has shown if the water supply is shut off to this type of building the flushometer toilets may have to be manually reset. Flooding of high-rise buildings has occurred in the past due to flushometer valves staying open after the water was shut off in the building. When water pressure resumes the flushometer values become an open valve, allowing water to flow under system pressure into the waste water collection system. Since the water is coming in under system pressure and flowing out under gravity flow, the waste water collection system becomes over loaded and cannot handle the volume. At that time, the toilets and urinals begin to over flow and run out into the whole building. It is important to understand this possibility when shutting off the water to some buildings while testing the backflow preventer (s). An addtional trip back into the building to inspect and test the operation of the flushometer valves will prevent this problem from becoming serious.

Buildings where parallel or dual supply lines are installed should be exempt from this problem since the internal plumbing system would never lose pressure in those instances.

CONTINUOUS SERVICE FACILITIES

Facilities which require water on an uninterrupted basis, such as hospitals and most industries, must have either two or more supply lines which are interconnected within the facility or have two or more backflow preventers installed in a parallel arrangement on the single incoming line. This will enable each device to be tested and repaired while the facility continues to receive water through the other device(s). When testing or repair is complete the device in question must be placed back in service. Each one of the assemblies in a parallel arrangement must be left in service with water flowing through them at all times except during testing or repair. If a backflow preventer is left in line but with the shut off valves in the off position two serious things will occur. The facility will not receive the water or pressure it may need, and the backflow preventer will become faulty due to build up of rust and debris.



FIRE PROTECTION SYSTEMS

Fire protection systems are considered to be a possible cross-connection and a source of potential contamination to the public water supply system for a number of reasons.

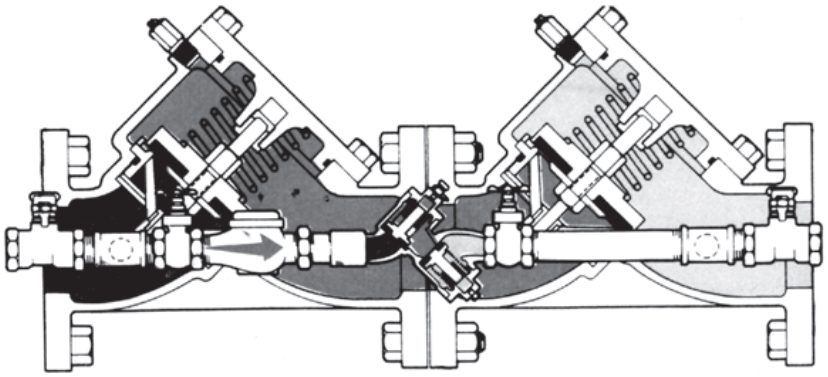
1. Since the water stands in most fire sprinkler systems for many months(and sometimes for years) without being flushed out, the growth of offensive microorganisms can create taste and odor problems. Since the pipes are not sterilized during or after being charged with water, coliform bacteria is normally present in such systems, as well.

2. Fire sprinkler systems are normally constructed with black iron pipe, which is not approved for potable water systems. Often metal cuttings and oil remain in the pipes from the cutting and threading process during construction. This can result in the leaching ofmetals such as zinc, cadmium, iron, or lead into the water.

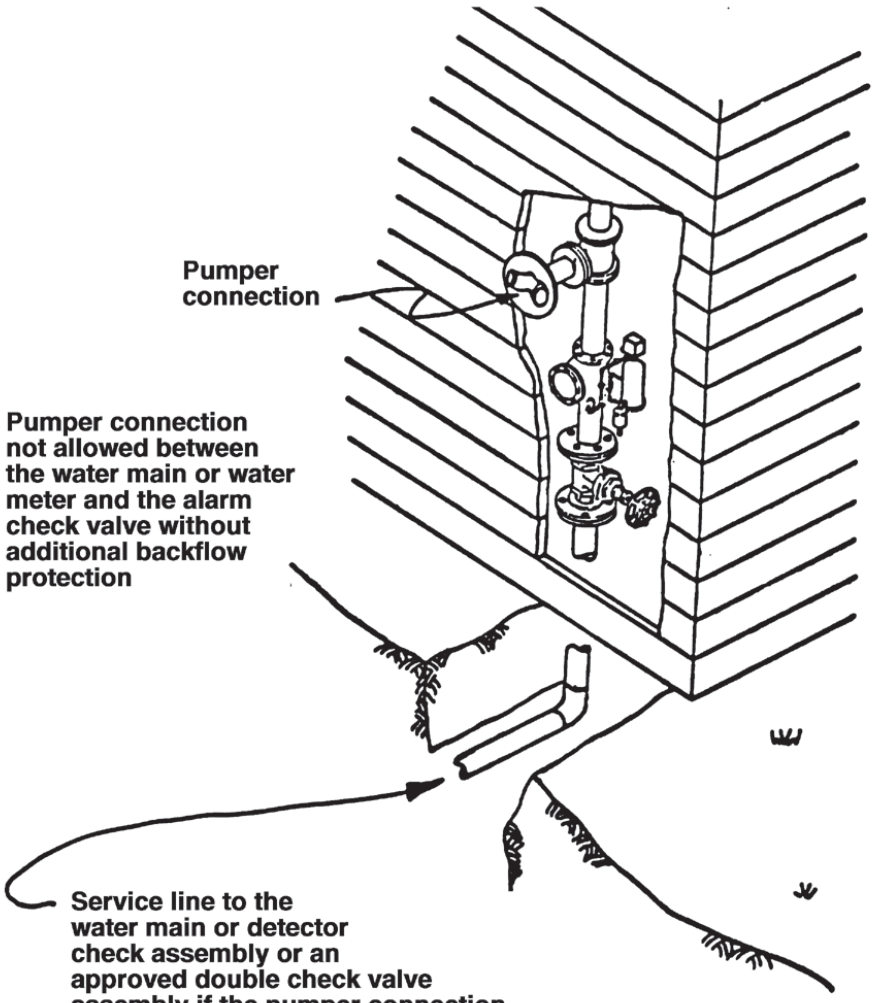
3. In some instances, the fire protection system is charged with chemicals which are not approved for use in potable water systems. Corrosion inhibitors or antifreeze are the most common ones. Additionally, foaming agents are often used in fire systems at jet-ports and military air bases.

4. The use of large booster pumps is common in fire protection systems at industrial complexes. Those booster and jockey pumps present a backpressure threat which can contaminate the public water system without warning. Some fire protection systems are even charged with water from a near by pond or reservoir, which is in no way considered to be potable and may even be highly contaminated.

DOUBLE DETECTOR CHECK VALVE ASSEMBLY
for fire protection systems

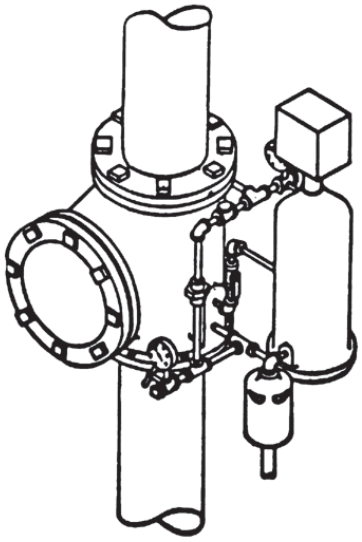


TYPICAL ALARM CHECK VALVE INSTALLATION



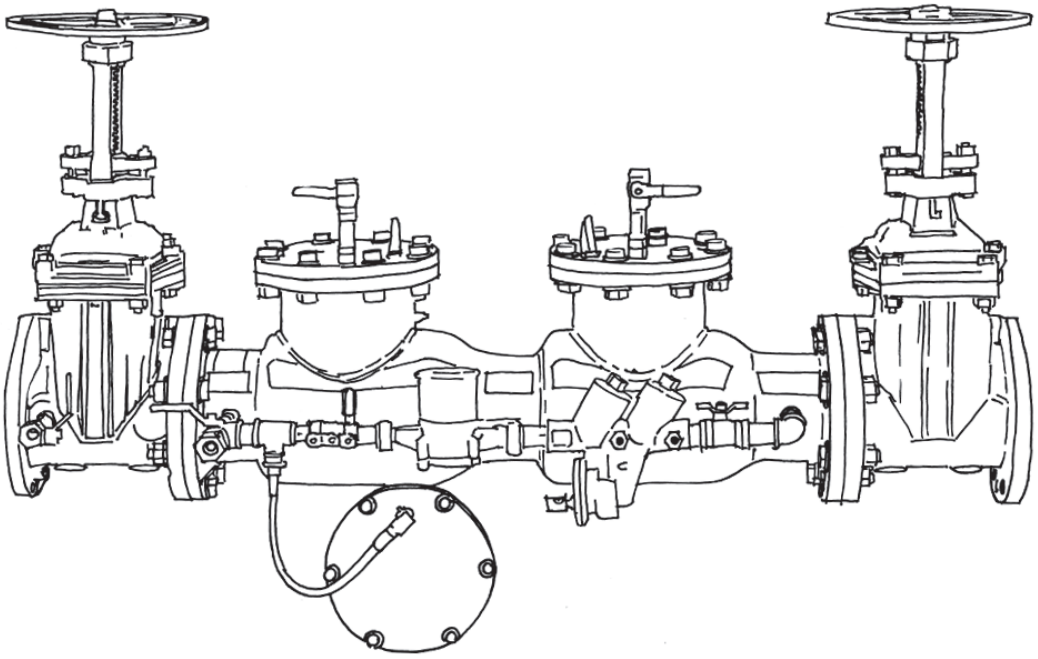
WET SYSTEM ALARM CHECK VALVE

(Not considered adequate backflow protection)

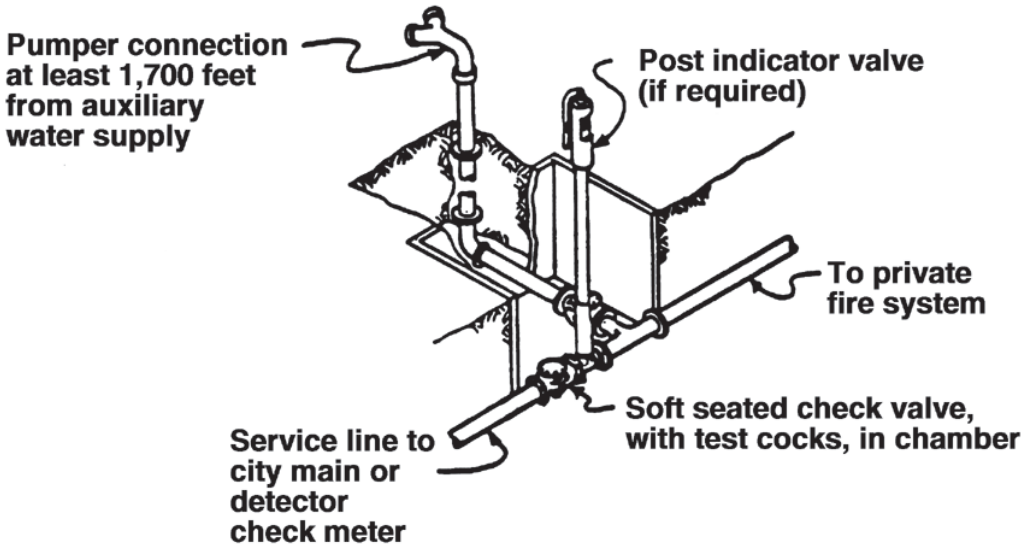


Valve may be installed horizontally or vertically

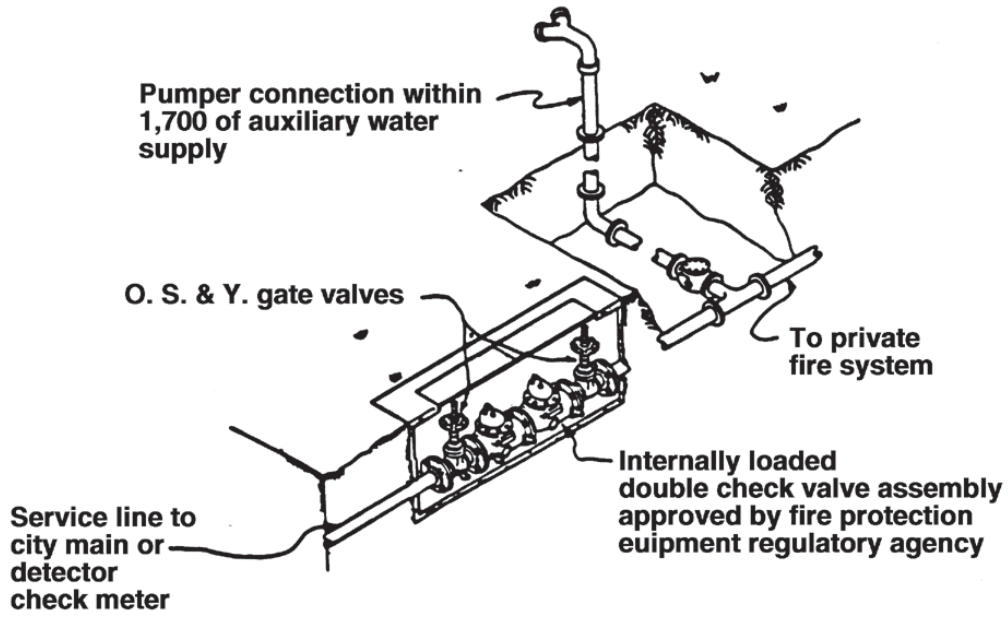
REDUCED PRESSURE DETECTOR ASSEMBLY
for fire protection systems



TYPICAL INSTALLATION OF SINGLE CHECK VALVE; FIRE PROTECTION SYSTEM



TYPICAL INSTALLATION OF DOUBLE CHECK VALVE ASSEMBLY; FIRE PROTECTION SYSTEM



REQUIREMENT

No fire line sprinkler system may be installed in South Carolina unless it is protected by a minimum of an APPROVED DOUBLE CHECK VALVE ASSEMBLY. This includes dry type systems, simple systems (without pumper connections) as well as systems where booster pumps and covered or protected auxiliary storage exist.

Those D.C.V.A.'s must be installed according to local and state plumbing and fire codes. Vertical, as well as pit installations of D.C.V.A.'s are allowed in most systems. **APPROVED DOUBLE CHECK VALVE ASSEMBLIES MUST BE TAKEN FROM THE D.H.E.C. LIST OF APPROVED DEVICES AND MUST BE EQUIPPED WITH FACTORY INSTALLED SHUT OFF VALVES. THE SHUT OFF VALVES MUST BE ATTACHED DIRECTLY TO THE D.C.V.A. IN ORDER FOR IT TO BE AN APPROVED ASSEMBLY.**

R.P.'S ON FIRE LINES

Approved Reduced Pressure Backflow Preventers are not considered to be compatible with fire protection systems, but are necessary under certain circumstances. When the degree of hazard is considered to be in the high hazard category a Reduced Pressure Backflow Prevention Assembly is necessary. Normally, such a requirement is reserved for a system where antifreeze or some other chemical has been added. Fire systems which are tied into the public potable system and take water from ponds, creeks, reservoirs, or some other source of non-potable water must be protected by Reduced Pressure Backflow Prevention Assemblies. Some municipalities require as a routine matter the installation of Reduced Pressure Backflow Prevention Assemblies on all fire lines. This is an expensive and unwise practice, and should be avoided.

Sometimes antifreeze is used on a limited number of sprinkler heads in a large fire protection system. The use of antifreeze in the lines on a loading dock, for instance, does not necessarily warrant the need for a R.P. on the large incoming line to the fire protection system. Instead, with local approval, a smaller R.P. may be installed on the line to the loading dock. This assembly should be installed just prior to the point of injection of the antifreeze and should be tested and maintained just like the large incoming line device. This practice can save the customer money as well as hydraulic problems by allowing the D.C.V.A. to remain on the incoming line to the system.

A Few Study Notes

(Not mandatory)

1) A Cross-Connection is an actual or_____ connection between the potable water system and a Non-Potable system or source...

2) The Two types of Backflow Are_____& _____.

3) Backsiphonage is caused by negative or reduced _____ in the supply piping.

4) Water traveling at high velocity past or through a small opening or restriction may cause backsiphonage by what effect? _____ or _____.

5) The installation criteria for an approved Air Gap is_____ and never less than _____.

6) The two types of Cross-Connections are Permanent/Direct or _____/_____.

7) The two types of facility protection are Isolation and _____.

8) Cross-Connection Control is mandated by the _____.

9) The minimum value on the 1st check valve of an RP is _____.

10) The minimum value on the 2nd check valve of an RP is _____.

11) The minimum value on the Relief valve opening of an RP is _____.

12) The minimum value on the 1st check valve of an DCVA is _____.

13) The minimum value on the 2nd check valve of an DCVA is _____.

14) The minimum opening point of the Air Inlet of a PVB is_____.

15) The minimum value on the Check Valve in a PVB is _____.

16) After the repair of an Assembly, a field test is required for the _____.

17) Continuous pressure is defined as pressure lasting for a period greater than _____ hours within a 24-hour period

18) A backflow preventer which creates a closed plumbing system may require the installation of a _____.

A Few Study Notes

(Not mandatory)

19) The type of facility backflow protection when a backflow preventor is installed after the meter to protect the general public from the facility as mandated by the Water Purveyor is_____.

20) A restriction or reduction in a pipe may cause water velocity to increase, thereby allowing for what type of backsiphonage _____.

21) The minimum of a _____must be installed on a fire line sprinkler system

22) Remember: All Vacuum Breakers can be used on _____ Hazard applications and any backflow with Check in the name is only used for only _____ Hazard applications.

23) Cross-Connection Control is mandated By the State, but it is the _____ _____ that has strict liability and enforces Cross-Control Programs.

24) A certified tester may have his/her tester's certification revoked due to incompetence or _____ of test results, as determined by the Department.

25) After receiving the SC DHEC Tester Certification testers much contact each & every _____ _____ they wish to test in….

Backflow Prevention Assembly Test & Maintenance Form

Owner of Property _____ **Return Form By:** _____

Mailing Address _____ Test Date _____

_____
(CITY) (ST) (ZIP)

Contact Person _____

Assembly Address _____

_____
(CITY) (ST) (ZIP)

Exact Location _____

☐ RP - ASSE #1013 ☐ RPDA - ASSE #1047

☐ DC- ASSE #1015 ☐ DCDA - ASSE #1048

☐ PVB - ASSE #1020 ☐ SRVB - ASSE #1056

Make _____ Model No. _____

Size _____ Serial No. _____

Line PSI _____	Reduced Pressure Backflow Preventer Double Check Valve Assembly			Pressure Vacuum Breaker Spill Resistant Vacuum Breaker	
	Check Valve No. 1	Check Valve No. 2	Relief Valve	Check Valve	Air Inlet
Initial Test **PASS** ☐ **FAIL** ☐	Closed Tight ☐ Leaked ☐ _____PSID	Closed Tight ☐ Leaked ☐ _____PSID	Opened at _____PSID Did Not Open ☐	Closed Tight ☐ Leaked ☐ _____PSID	Opened at _____PSID Did Not Open ☐
Repairs					
Final Test **PASS** ☐	Closed Tight ☐ _____PSID	Closed Tight ☐ _____PSID	Opened at ☐ _____PSID	Closed Tight ☐ _____PSID	Opened at _____PSID

Condition of No. 2 Shutoff Valve: Closed Tight ☐ Leaked ☐ Water Service Restored Yes ☐ No ☐

Notes:

Certification: On this date, the above device was tested per applicable codes and the required performance standards.

Test Type		Gauge Ser. No.		Testing Firm	
Tester Name				Tester Certification No.	

Tester Signature: _____ Date: _____

DHEC 2132 (11/2019)

This is a sample Test Report Form. Many Jurisdictions require use of their unique forms. Check with local Jurisdiction before testing to ensure correct forms are used

Backflow Parts & Gauge Information

American Backflow Products Company 7580 West Tennessee Street Tallahassee FL 32304 (800) 575-9618 customerservice@backflowparts.com	• Repair Parts • Backflow Assemblies & Devices & Tags • **Trouble Shooting help** • Testing Equipment • Gauge Certification/Calibration/Repair (Contact about Digital Gauges)
Northwestern Supply, Inc. 2054 Sandifer Blvd. Seneca, SC 29678 864-885-1160 info@northwesternsupplyinc.com	• Gauge Certification • Testing Equipment • Repair Parts
Specialty Valve 3001 Griffith Street Charlotte NC 28203 704 522 9873	• Testing Equipment • Gauge Certification/Calibration/Repair (Contact about Digital Gauges)
BAVCO-East Coast 1201-F Technology Drive Indian Trail, NC 28079 (844) 202-1618 / (704) 684-0008 ncinfo@bavco.com	• Repair Parts • Testing Equipment • Gauge Certification/Calibration/Repair (Contact about Digital Gauges)
Gage-It, Inc. 94 N. Branch Street Sellersville, PA 18960 800-869-7294 www.gageitinc.com/contact.php	• Testing Equipment • Gauge Certification/Calibration/Repair
Conbraco Calibration Services 1418 S Pearl St Pageland, SC 29728 (843) 672-1616	• Gauge Certification/Calibration
Sun Graphic Technologies, Inc. 2310 Whitfield Park Avenue Sarasota, FL 34243 backflowtags.sungraphictechnologies.com/	• Custom Backflow Tags
AppMet 7308 Peppermill Pkwy North Charleston, SC 29418 P: 843-767-5664 www.appmet.com	• Gauge Certification Only
Backflow Parts Connection Jim Ferguson 159 Bain Ln . Mooresville, NC 28117 704-999-5060	• Repair Parts

** The above information is not all inclusive and is for informational purposes only. SC DHEC is not endorsing any one organization over another, only supplying contact information for organizations that have asked to be included in the course information. **


dhec
Healthy People. Healthy Communities.