What is a Cross Connection?

A cross connection is a point in a plumbing system where the potable water supply is connected to a non-potable source. Briefly, a cross connection exists whenever the drinking water system is or could be connected to any non-potable source (plumbing fixture, equipment used in any plumbing system). Pollutants or contaminants can enter the safe drinking water system through uncontrolled cross connections when backflow occurs.

Backflow is the unwanted flow of non-potable substances back into the consumer's plumbing system and/or public water system (i.e., drinking water).

There are two types of backflow: ***backsiphonage*** and ***backpressure***. ***Backsiphonage*** is caused by a negative pressure in the supply line to a facility or plumbing fixture. Backsiphonage may occur during waterline breaks, when repairs are made to the waterlines, when shutting off the water supply, etc.

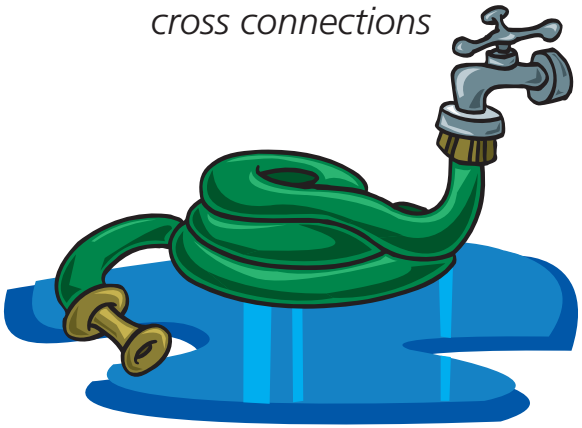
Backpressure can occur when the potable water supply is connected to another system operated at a higher pressure or has the ability to create pressure. Principal causes are booster pumps, pressure vessels and elevated plumbing.

Backflow preventers are mechanical devices designed to prevent backflow through cross connections. However, for backflow preventers to protect as designed, they must meet stringent installation requirements.

For further information contact your local water purveyor or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992 or on the web at www.pnws-awwa.org

Cross Connections can create Health Hazards

Drinking water systems may become **Polluted** *or* **Contaminated** *through uncontrolled cross connections*



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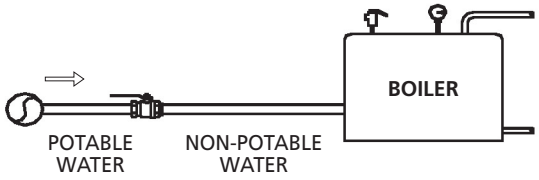
Why Be Concerned?

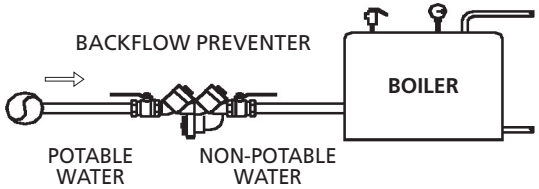
Most water systems in the United States and Canada have good sources of water and/or sophisticated treatment plants to convert impure water to meet drinking water standards. Millions of dollars are spent to make the water potable before it enters the distribution system so most water purveyors think that their supplies are not in jeopardy from this point on. Studies have proven this to be wrong. Drinking water systems may become polluted or contaminated in the distribution system through uncontrolled cross connections.

Cross connections are installed each day in the United States because people are unaware of the problems they can create. Death, illness, contaminated food products, industrial and chemical products rendered useless are some of the consequences of such connections. As a result, many hours and dollars are lost due to ***cross connections***.

Wrong:
Uncontrolled Cross Connection



Right:
Controlled Cross Connection



Where are Cross Connections Found?

Cross connections are found in all plumbing systems. It is important that each cross connection be identified and evaluated as to the type of backflow protection required to protect the drinking water supply. Some plumbing fixtures have built-in backflow protection in the form of a physical air gap. However, most cross connections will need to be controlled through the installation of an approved mechanical backflow prevention device or assembly. Some common cross connections found in plumbing and water systems include:

1. Wash basins and service sinks.
2. Hose bibs.
3. Irrigation sprinkler systems.
4. Auxiliary water supplies.
5. Laboratory and aspirator equipment.
6. Photo developing equipment.
7. Processing tanks.
8. Boilers.
9. Water recirculating systems.
10. Swimming pools.
11. Solar heat systems.
12. Fire sprinkler systems.

Every water system has cross connections. Plumbing codes and State drinking water regulations require cross connections to be controlled by approved methods (physical air gap) or approved mechanical backflow prevention devices or assemblies. The various types of mechanical backflow preventers include: reduced pressure backflow assembly (RPBA), reduced pressure detector assembly (RPDA), double check valve assembly (DCVA), double check detector assembly (DCDA), pressure vacuum breaker assembly (PVBA), spill resistant vacuum breaker assembly (SVBA) and atmospheric vacuum breaker (AVB).

For a backflow preventer to provide proper protection, it must be approved for backflow protection, designed for the degree of hazard and backflow it is controlling, installed correctly, tested annually by a State certified tester, and repaired as necessary. Some states require mandatory backflow protection on certain facilities where high health-hazard-type cross connections are normally found. The following is a partial list of those facilities:

1. Hospitals, mortuaries, clinics.
2. Laboratories.
3. Food and beverage processing centers.
4. Metal plating and chemical plants.
5. Car washes.
6. Petroleum processing and storage plants.
7. Piers and docks.
8. Sewage treatment plants.

What to Do?

It is impossible to cover all of the information pertaining to cross connections in a pamphlet. We hope the preceding information will inspire you to further educate yourself on the hazards of unprotected cross connections. Cross connection control manuals and training schools are offered throughout the Northwest. Information on manuals, schools and cross connection control can be obtained from:

Washington

Department of Health
Airdustrial Way, Bldg. 3
P.O. Box 47822
Olympia WA 98504-7822
(360) 236-3133

Oregon

Oregon Health Division
3420 Cherry Av NE, #110
Keizer OR 97303
(503) 373-7201

British Columbia, Canada

BC Water & Waste Association
Ste. 342 – 17 Fawcett Road
Coquitlam B.C. V3K 6V2
(604) 540-0111

Idaho

Idaho Division of Environment
1410 N Hilton
Boise ID 83706
(208) 373-0275

Additional sources of information may be found on the PNWS-AWWA web site:
www.pnws-awwa.org

Common Household Hazards

Chemical Spray Applicators

The chemicals used on your lawn and garden can be toxic or fatal if ingested. These chemicals include pesticides, herbicides, and fertilizers. Even strong cleaning chemicals sprayed on cars, house siding, etc., may cause health problems if ingested.

Submerged Hoses

Water held in pools, ponds or other vats open to the air and exposed to humans or animals may contain microbiological contaminants. Hoses submerged in buckets or containers can act as a conduit for contaminants under backflow conditions.

Underground Lawn Irrigation Systems

Underground irrigation systems often have puddles of standing water around the ground-level sprinkler heads. The sprinkler heads **are not** designed to be drip-tight under backflow conditions. The puddles of water may contain microbiological contaminants, such as excrement from animals or chemical residue from fertilizer and herbicides sprayed on the lawn.

For further information contact your local water purveyor or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992 or on the web at www.pnws-awwa.org

Help protect your
Drinking Water
from
Contamination

Household Hazards

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Pacific Northwest Section

How Contamination Occurs

Water normally flows in one direction, from the public water system through the customer's cold or hot water plumbing to a sink tap or other plumbing fixture. The plumbing fixture is the end of the potable water system and the start of the waste disposal system.

Under certain conditions water can flow in the reverse direction. This is known as ***backflow***. Backflow occurs when a backsiphonage or backpressure condition is created in a water line.

Backsiphonage may occur due to a loss of pressure in the water distribution system during a high withdrawal of water for fire protection, a water main or plumbing system break, or a shutdown of a water main or plumbing system for repair. A reduction of pressure below atmospheric pressure creates a vacuum in the piping. If a hose bib was open and the hose was submerged in a wading pool during these conditions, the non-potable water in the pool would be siphoned into the house's plumbing and back into the public water system.

Backpressure may be created when a source of pressure, such as a pump, creates a pressure greater than that supplied from the distribution system. If a pump supplied from a non-potable source, such as a landscape pond, was accidentally connected to the plumbing system, the non-potable water could be pumped into the potable water supply.

How to Prevent Contamination of Your Drinking Water

Protect your drinking water by taking the following precautions:

Don't:

- Submerge hoses in buckets, pools, tubs, sinks, ponds, etc.
- Use spray attachments without a backflow prevention device.
- Connect waste pipes from water softeners or other treatment systems to the sewer, submerged drain pipe, etc.
- Use a hose to unplug blocked toilets, sewers, etc.

Do:

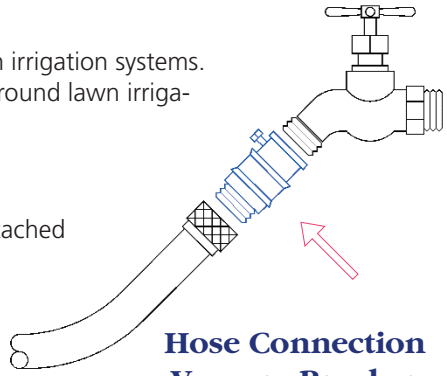
- ✔ Keep the ends of hoses clear of all possible contaminants.
- ✔ If not already equipped with an integral (built-in) vacuum breaker, buy and install hose bib type vacuum breakers on all threaded faucets around your home. These devices are inexpensive and are available at hardware stores and home improvement centers.
- ✔ Install an approved backflow prevention assembly on all underground lawn irrigation systems. Remember, a plumbing permit is required for the connection of an underground lawn irrigation system to your plumbing system.

Hose Connection Vacuum Breaker

Hose connection vacuum breakers are specifically made for portable hoses attached to threaded faucets. Their purpose is to prevent the flow of contaminated water back into the drinking water. These devices screw directly to the faucet outlet. They can be used on a wide variety of installations, such as service sinks, hose faucets near a wading pool, laundry tub faucets, etc.

Some units are designed for manual draining for freezing conditions. Some are furnished with breakaway set screws as a tamper proof feature.

These device are not intended for operation under continuous pressure.



Hose Connection Vacuum Breaker

Protection of the Water Purveyor's Distribution System

In general, the installation of plumbing in compliance with the plumbing code will provide adequate protection for your plumbing system from contamination.

However, the water purveyor may require (as a condition of service) the installation of a backflow prevention assembly on the water service to provide additional protection for the public water system. A backflow prevention assembly will normally be required where a single-family residence has special plumbing that increases the hazard above the normal level found in residential homes, or where a hazard survey cannot be completed.

To help determine if a backflow prevention assembly is required, the water purveyor may send residential customers a Cross Connection Control Survey Questionnaire. The water purveyor will evaluate the returned questionnaires to assess the risk of contamination to the public water system. Based on the results of the evaluation, the installation of backflow prevention assemblies may be required on services to some customers.

Approved Backflow Assemblies

The water purveyor relies on approved backflow prevention assemblies to protect the public water system. Approved assemblies are manufactured with isolation valves and test cocks to permit field-testing to demonstrate that the assemblies are properly functioning to prevent backflow.

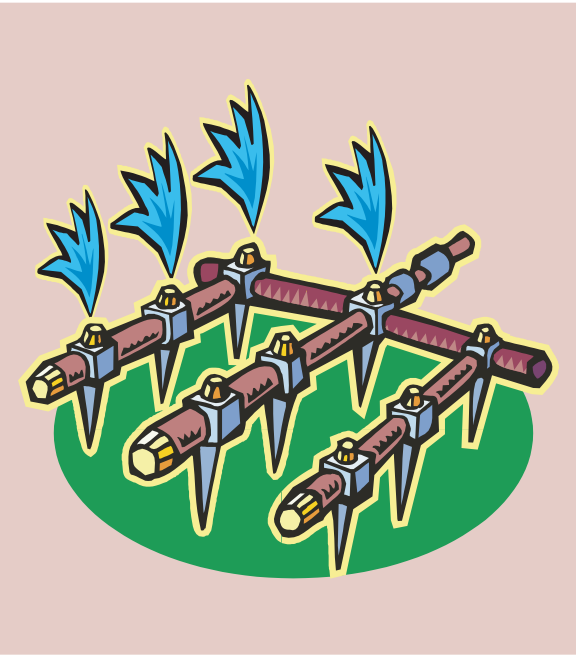
In addition to the above assemblies, plumbing codes also allow the use of atmospheric vacuum breakers (AVB) on lawn irrigation systems without chemical addition. Because an atmospheric vacuum breaker is not designed to be tested, some water purveyors require the installation of approved, testable assemblies. Contact your water purveyor regarding the requirements for isolation of your lawn irrigation system.

Note:

All irrigation piping should be considered a non-potable water system due to an actual or potential health hazard.

For further information contact your local water purveyor or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992 or on the web at www.pnws-awwa.org

Lawn Irrigation Systems and Backflow Prevention



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Lawn (Turf) Irrigation Systems

For the protection of the water purveyor's distribution system, all irrigation systems must have an approved backflow prevention assembly that is compatible with the degree of hazard. Irrigation systems are categorized as high health hazard or moderate health hazard as defined below.

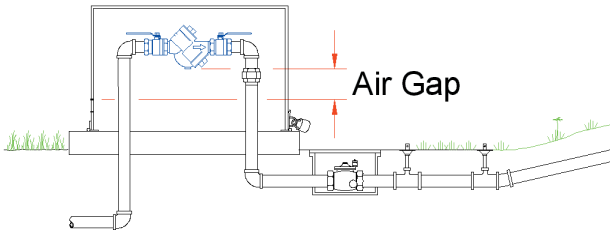
Any irrigation system that contains pumps or injectors for the addition of chemicals and/or fertilizers is considered a high hazard. This risk assessment is also based on the additional hazard posed by bacterial contaminants found on lawns, and on the possibility of changes being made to the irrigation system by the customer. An approved reduced pressure backflow assembly (RPBA), or an approved air gap separation, should be required in all cases where chemicals or herbicides may be injected into the irrigation system, or where an auxiliary water supply is also provided for irrigation water.

All irrigation systems that are not classified as a high health hazard are considered to be moderate health hazards. This risk assessment is based on the hazard posed by bacterial and chemical contaminants found on lawns, and on the possibility of changes being made to the irrigation system by the customer. An approved double check valve assembly (DCVA), or pressure vacuum breaker assembly (PVBA), should be required.

However, an approved PVBA does not provide adequate protection if it is subjected to flooding, backpressure, elevated piping, or if compressed air is used to winterize the irrigation system. In these situations, an approved DCVA should be required as a minimum level of protection.

Reduced Pressure Backflow Assembly for Isolation of Lawn Irrigation System

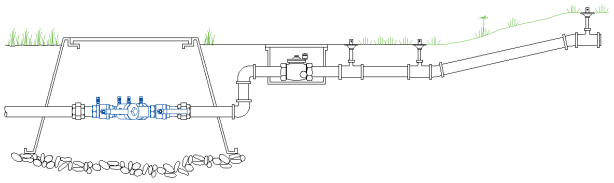
- The reduced pressure backflow assembly (RPBA) should be installed to isolate irrigation systems using injectors or pumps to apply fertilizer and other agricultural chemicals.
- The RPBA must be installed above ground to prevent the relief valve opening from becoming submerged.
- The RPBA should be installed in an insulated enclosure to provide freeze protection.
- The RPBA should be tested by a certified backflow assembly tester upon installation, after repair of relocation, and at least annually.



Reduced Pressure Backflow Assembly in Above-Ground Enclosure

Double Check Valve Assembly for Isolation of Lawn Irrigation System

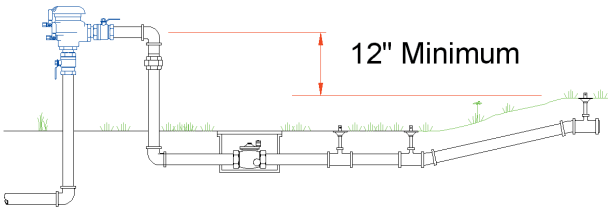
- The double check valve assembly (DCVA) may be installed to isolate all irrigation systems that do not use injectors or pumps to apply fertilizer and other agricultural chemicals.
- The DCVA may be installed in a below-ground enclosure provided the assembly test cocks are plugged; the test cocks are pointed up; adequate space is provided for maintenance and testing; and any compressed air connections are installed only downstream of the DCVA.
- The DCVA shall be tested by a certified backflow assembly tester upon installation, after repair of relocation, and at least annually.



Double Check Valve Assembly in Below-Ground Box

Pressure Vacuum Breaker Assembly for Isolation of Lawn Irrigation Systems

- The pressure vacuum breaker assembly (PVBA) may be installed to isolate all irrigation systems that do not use injectors or pumps to apply fertilizer and other agricultural chemicals.
- The PVBA shall be installed at least 12 inches above the highest point in the irrigation piping.
- The PVBA shall be tested by a certified backflow assembly tester upon installation, after repair of relocation, and at least annually.



Pressure Vacuum Breaker Assembly

Protection from Thermal Expansion

Protection from thermal expansion is provided in a plumbing system by the installation of a ***thermal expansion tank*** in the hot water system piping downstream of the hot water tank and a ***temperature and pressure relief valve*** (T & P Valve) at the top of the tank.

The thermal expansion tank controls the increased pressure generated within the normal operating temperature range of the water heater. The small tank with a sealed compressible air cushion provides a space to store and hold the additional expanded water volume.

The T & P Valve is the primary safety feature for the water heater. The ***temperature*** portion of the T & P Valve is designed to open and vent water to the atmosphere whenever the water temperature within the tank reaches approximately 210° F (99° C). Venting allows cold water to enter the tank.

The ***pressure*** portion of a T & P Valve is designed to open and vent to the atmosphere whenever water pressure within the tank exceeds the pressure setting on the valve. The T & P Valve is normally pre-set at 125 psi or 150 psi.

Water heaters installed in compliance with the current plumbing code will have the required T & P Valve and thermal expansion tank. For public health protection, the water purveyor may require the installation of a check valve or backflow preventer downstream of the water meter. In these situations, it is essential that a T & P Valve and thermal expansion tank be properly installed and maintained in the plumbing system.

For further information contact your local water purveyor, City or County building department, licensed plumber or the PNWS/AWWA Cross-Connection Control Committee through the PNWS office at (877) 767-2992 or on the web at www.pnws-awwa.org

Protect Your ***Water Heater*** *from* Thermal Expansion

Without a functioning Temperature & Pressure Relief Valve your water heater can

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Pacific Northwest Section

Thermal Expansion Danger

Most homes are supplied with hot water from an electric or gas heated tank. Until the heating element stops working, and one is faced with a cold shower, the water heater is usually taken for granted. However, if not properly maintained, a water heater may become a safety hazard.

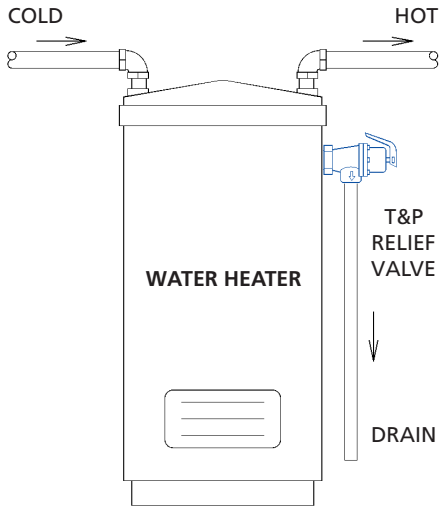
Water expands in volume as its temperature rises. The extra volume caused by thermal expansion must go somewhere. If not, the heated water creates an increase in pressure. This is the principle of a steam engine.

The temperature and pressure in the water heater is reduced when hot water is withdrawn from a faucet and cold water enters the tank. The increase in pressure from thermal expansion can also be reduced by water flowing back into the public water system. However, when a check valve, pressure-reducing valve or backflow preventer is installed in the service pipe a "closed system" is created. Provisions must be made for thermal expansion in these cases.

The thermostat of the water heater normally maintains the water temperature at about 130° F (54° C). However, if the thermostat fails to shut off the heater, the temperature of the water will continue to increase.

If the water temperature increases to more than 212° F (100° C), the water within the tank becomes "super heated". When this super heated water is suddenly exposed to the atmosphere when a faucet is opened, it instantly turns to steam. As the pressure within the tank continues to build up under super heated conditions, the tank may explode.

T&P Valve Location



Why the Installation of a Backflow Preventer is Required on a Water Service

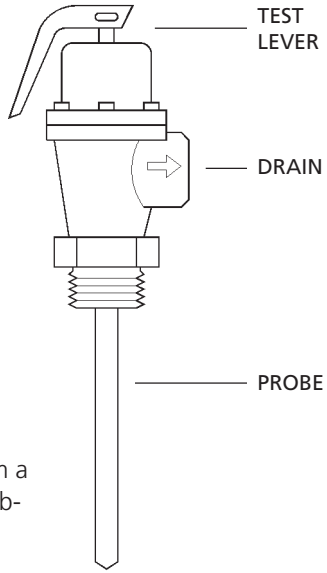
Water normally flows in one direction, from the public water system through the customer's cold or hot water plumbing to a sink tap or other plumbing fixture. The plumbing fixture is the end of the potable water system and the start of the waste disposal system.

Under certain conditions water can flow in the reverse direction. This is known as ***backflow***. Backflow occurs when a backsiphonage or backpressure condition is created in a water line.

Backsiphonage may occur due to a loss of pressure in the water distribution system during a high withdrawal of water for fire protection, a water main or plumbing system break, or a shutdown of a main or plumbing system for repair. A reduction of pressure below atmospheric pressure creates a vacuum in the piping. If a hose bib was open and a flowing hose was submerged in a wading pool during these conditions, the non-potable water in the pool would be siphoned into the house plumbing then back into the public water system.

Backpressure may be created when a source of pressure, such as a pump, creates a pressure greater than that supplied from the distribution system. If a pump supplied from a non-potable source, such as a landscape pond, were accidentally connected to the plumbing system, the non-potable water could be pumped into the potable water supply.

Typical T&P Valve



What the Homeowner Should Do to Ensure Protection from Thermal Expansion

- The homeowner should check to see that an expansion tank and T & P Valve are in place. If there is any doubt, the homeowner should contact a licensed plumber.
- The T & P Valve should be periodically inspected to ensure that is properly operating. Some T & P Valves are equipped with a test lever. Manually lifting the lever unseats the valve, allowing water to discharge. If water continues to leak from the T & P Valve after closing, the valve may need to be replaced. A drain line must be installed to avoid water damage and scalding injury when the valve operates.
- The T & P Valve should be periodically removed and visually inspected for corrosion deposits and to insure it has not been improperly altered or repaired.
- The above work can best be done by a licensed plumber.

This brochure is published by the Western Washington Cross Connection Prevention Professional Group (WWCCPP)
PO Box 94551
Seattle WA 98124

Provided By

The Local Water Purveyor

For more information, special installation requirements or to schedule an initial inspection, please contact the local Water Purveyor.

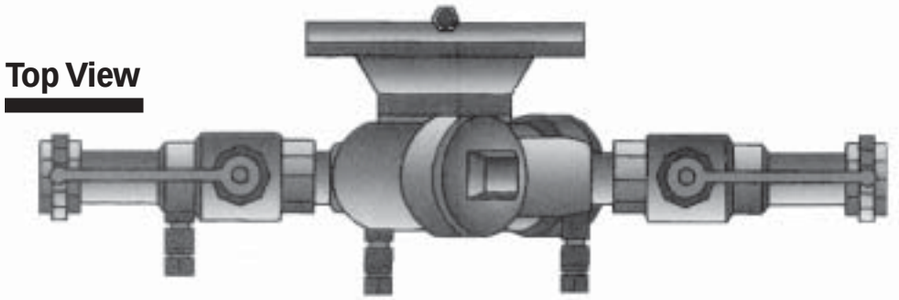
Proper Installation Procedures for

The Reduced Pressure Backflow Assembly & The Reduced Pressure Detector Assembly

THE GROUP
Western Washington Cross Connection Prevention Professionals

Help Us Protect Your Drinking Water

Top View



Reduced Pressure Backflow Assembly/Reduced Pressure Detector Assembly

1) Thoroughly flush service line prior to installation of assembly.

2) The backflow assembly shall be a Washington State Approved Backflow Assembly and must be:
   - Installed as a unit,
   - Accessible for testing and maintenance,
   - Protected from freezing and vandalism, Installed no higher than 5 feet from floor to centerline of assembly and a minimum of 12 inches from floor to bottom of assembly, and
   - If installed* in a vertical configuration, assembly must be a minimum of 23 inches from floor, and no higher than 5 feet from floor to center of #2 shut off valve.

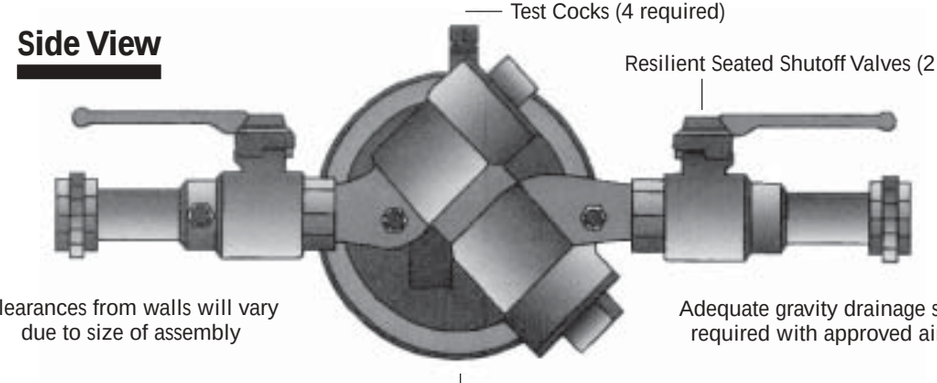
   *Only assemblies with approval from USC & DOH

3) Do not install in an area subject to flooding. Assemblies must be installed above ground.

4) Assembly must be tested after initial installation, annually, after repairs or after relocation or reinstallation. Contact the Water Purveyor for inspection of all newly installed assemblies.

5) Test reports must be signed by a certified Backflow Assembly Tester and immediately sent to Local Water Purveyor.

Side View



Reduced pressure backflow assembly/reduced pressure detector assembly procedure requirements:

1) All assemblies must be on the Washington State Approved Backflow Assembly List. This list is available through the Department of Heath, (360) 236-3140/1800-521-0323.

2) **ALL ASSEMBLIES ARE REQUIRED TO BE TESTED BY A WASHINGTON STATE CERTIFIED TESTER UPON INSTALLATION AND ANNUALLY. IN ADDITION, ASSEMBLIES MUST BE TESTED AFTER REPAIRS, RELOCATION OR REINSTALLATION.**

   Please note: Air gaps installed in lieu of a reduced pressure backflow assembly also require annual inspection. Test reports must be submitted immediately to Local Water Purveyor.

3) Contact Local Water Purveyor for inspection of all newly installed assemblies.

4) When choosing the backflow assembly, consult Local Water Purveyor to ensure it is the right assembly for the application, is appropriate for the water temperature and is sized hydraulically to avoid excessive pressure loss.

5) When installing an assembly inside a building, ensure assembly is located where occasional spitting from the relief valve port, a fouled check, or water flushed out during the annual test will not be objectionable. Proper drainage must be provided.

6) Protect assembly from freezing, flooding and mechanical damage due to water hammer and excessive pressure build up.

Assembly installation requirements for reduced pressure backflow assembly/reduced pressure detector assembly:

1) **CONTACT LOCAL WATER PURVEYOR TO ENSURE YOU ARE INSTALLING THE CORRECT ASSEMBLY FOR THE DEGREE OF HAZARD.**

2) Assembly must be installed as a unit, including two shut off valves, relief port, two check valves and four test cocks. All assemblies are required to be installed as a unit in the configuration they were approved by USC.

3) **THOROUGHLY FLUSH** the waterline prior to installing assemblies.

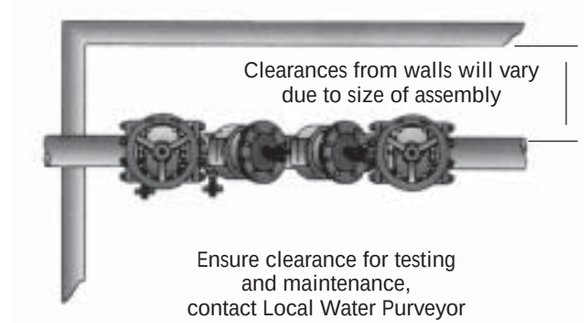
4) Assemblies must be installed a minimum of 12 inches from the bottom of the relief port, and no higher than 5 feet from floor* to centerline of assembly. All assemblies must be installed horizontally, unless they have Washington State approval to be installed vertically. If installed in a vertical configuration, it must be a minimum of 12 inches from floor, and no higher than 5 feet from floor* to center of the #2 shut off valve. All assemblies must maintain a sufficient clearance from any wall to ensure accessibility of maintenance and testing. Clearances may vary on small units - contact the Local Water Purveyor. Sizes 2 1/2 inches and larger in diameter may require additional space on one side of the assembly. Assemblies 2 1/2 inches and larger in diameter shall have support blocks to prevent flange damage.

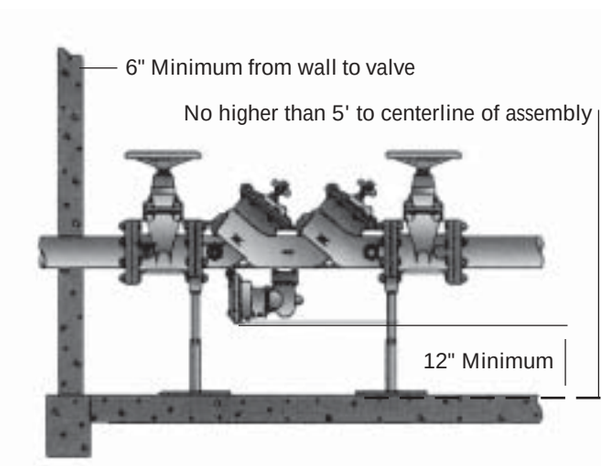
* An assembly installed more than 5 feet above floor or ground level must have a permanent platform under it for the tester or maintenance person to stand on. The platform must comply with all applicable safety standards and codes in effect.

REDUCED PRESSURE BACKFLOW ASSEMBLIES CANNOT BE INSTALLED BELOW GROUND AT ANY TIME.

ASSEMBLIES MUST MEET ABOVE REQUIREMENTS TO ENSURE ACCESSIBILITY FOR TESTING, MAINTENANCE AND APPROVAL OF THE WATER PURVEYOR. VARIANCE OF ANY INSTALLATION MUST HAVE PRIOR WRITTEN APPROVAL OF LOCAL WATER PURVEYOR.

Top View





Side View

Requirements for air gaps:

1) Air gap must be twice the diameter of the inlet pipe, minimum of 1 inch.

2) The air gap must provide a physical separation from the bottom of the inlet piping to the top of the overflow rim of the receiving vessel.

3) If inlet piping is cut diagonally to decrease splashing, the air gap separation is measured from the bottom of the cut to the receiving vessel.

4) If air gap is located near sidewalks, the separation increases to three times the diameter of the inlet piping, minimum of 1 1/2 inches.

Reduced pressure detector assembly:

1) Assembly shall be installed as a unit as it is approved by DOH and USC.

2) All assemblies must maintain a sufficient clearance from any wall to ensure accessibility for maintenance and testing.

3) When testing a Reduced Pressure Detector Assembly, both assemblies must be tested and two test reports submitted to the Local Water Purveyor.

4) All other requirements are the same as the Reduced Pressure Backflow Assembly.