Cross Connections

A cross connection is a direct connection of a non-potable water source with a potable source. Cross connections can result in serious illness and even death. Backflow can be the result of a cross connection which can affect water quality and create health problems.

One of the most notorious incidents of cross connection was the “Holy Cross Episode,” when many members of the Holy Cross football team developed infectious hepatitis as a result of contact with contaminated water pooled around a sprinkler head. The water supply became contaminated when a partial vacuum in the water distribution system was created due to a nearby fire which drew contaminated water back into the potable water supply.

Another backflow contamination case occurred in Minnesota in 1978 after an herbicide was backsiphoned from a farmer’s tank truck into a city’s water system. The farmer filled his water tank from a hose by the city’s water plant. The water pressure suddenly dropped and the pesticide in the truck was siphoned into the city’s water system. Fortunately, no illness from the contamination occurred, but the city had to limit its water use until the entire system could be flushed and refilled with clean water.

BACKFLOW

Backflow is defined as undesired, reversed flow of liquid in a piping system. Backflow can be caused by back siphonage, back pressure, or a combination of the two.

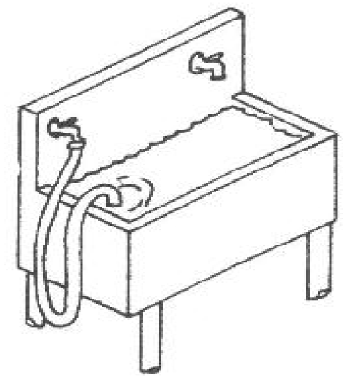
1. Back-siphonage backflow occurs when there is a partial vacuum (negative pressures) in a water-supply system, drawing the water from a contaminated source into a potable water supply. The effect is similar to sipping a soda by inhaling through a straw. For example, during a large fire, a pumper is connected to a hydrant; high flows pumped out of the distribution system can result in significantly reduced water pressure around the withdrawal point. A partial vacuum has been created in the system, causing suction of contaminated water into the potable water system. During such conditions, it is possible for water to be withdrawn from non-potable sources such as air-conditioning systems, water tanks, boilers, fertilizer tanks and washing machines into buildings located near a fire. The same conditions can be caused by a water-main break.

2. Back-pressure backflow occurs when the pressure of the non-potable system exceeds the positive pressure in the water distribution lines. For example, there is a potable water connection to a hot water boiler system that is not protected by an approved backflow preventer. If pressure in the boiler system increases to a point that it exceeds the pressure in the potable water distribution system, a backflow from the boiler to the potable water system may occur.

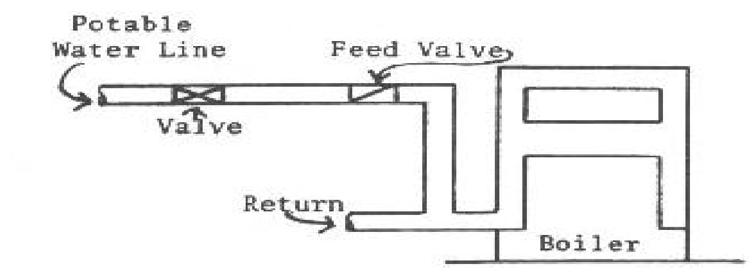
CROSS CONNECTIONS

Cross connections can occur in a variety of locations, including commercial buildings, hospitals, farms, houses, and apartment complexes. The following examples illustrate cross connections:

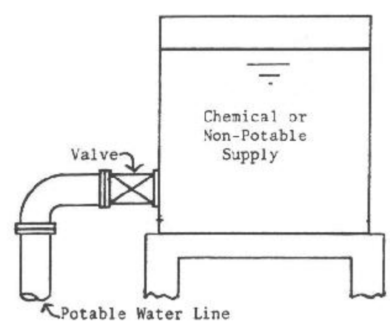
1. A prevalent type of cross connection is illustrated by a hose connected to a sillcock with the other end of the hose lying in a pool or sink full of polluted or contaminated water. In this case backflow occurs by back siphonage. If a partial vacuum is set up in the water distribution system, water can be drawn from the tank by suction when the faucet is opened.



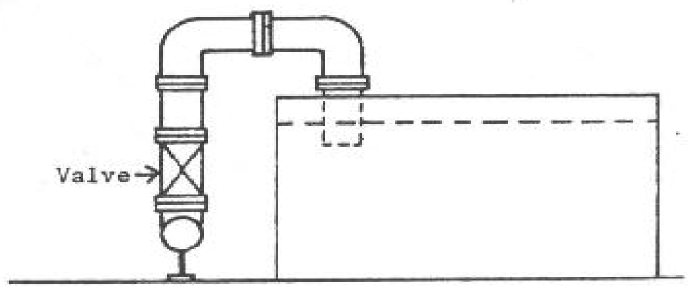
2. Cross connection to pressurized systems, such as a hot water boiler, is not uncommon. In this case backflow can occur by back pressure and by back siphonage. Back pressure backflow can occur when the water pressure in the boiler or pressurized tank exceeds the positive pressure in the water distribution lines.



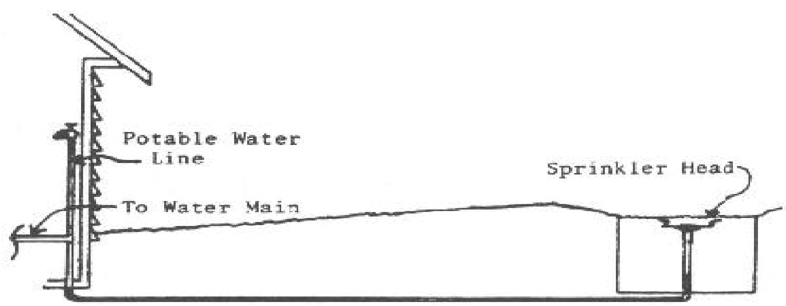
3. A cross connection to an elevated tank containing a non-potable substance can cause backflow by back pressure. Backflow can occur if the valve is left open and the pressure caused by the water elevation in the tank exceeds the line pressure.



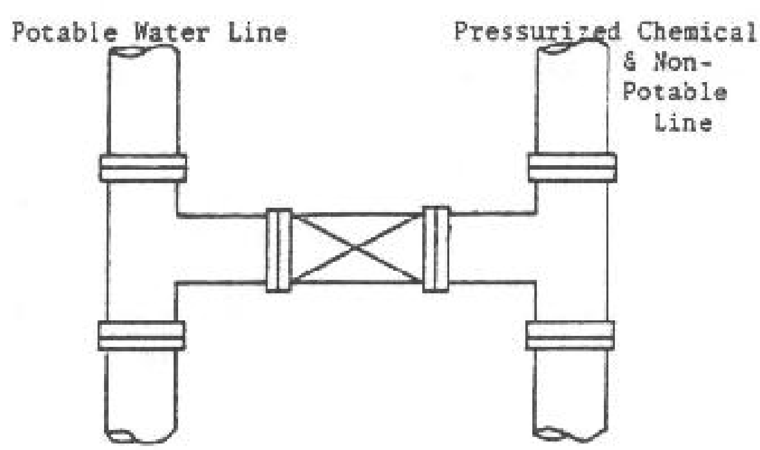
4. A cross connection is created when an open tank is connected to a water line with no air gap. When the valve is opened, back siphonage can occur if a partial vacuum develops in the water system that draws water from the tank into the water system.



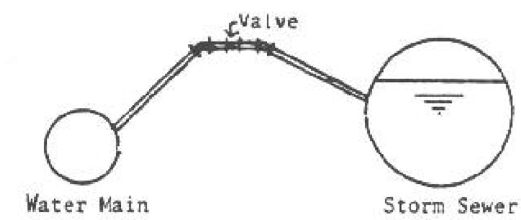
5. A cross connection to a sprinkler system can cause back siphonage when a partial vacuum in the water system draws water from pooled water near a sprinkler head. This type of cross connection led to the "Holy Cross Episode" that was mentioned earlier. Backflow caused by back pressure can occur when the sprinkler head is at a higher elevation than the connection to the potable water system.



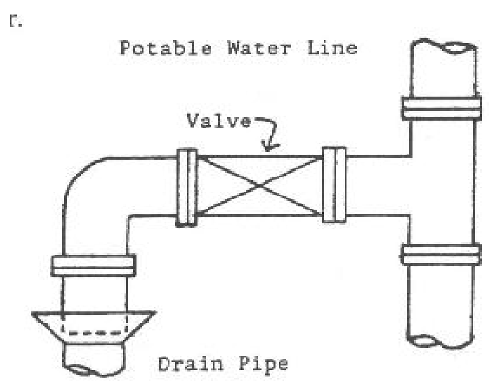
6. A cross connection to a pressurized pipe carrying contaminated water can cause backflow. When the valve is opened, backflow by back pressure can occur if the pressure in the non-potable lines is higher than the positive pressure in the potable system.



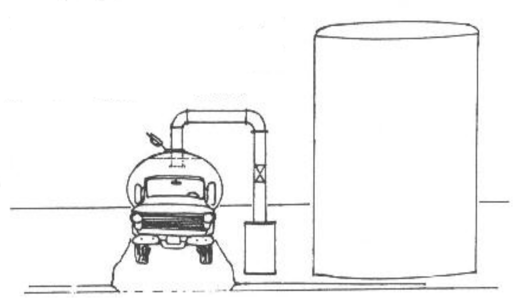
7. A cross connection to a gravity sewer can be created when a water main is connected to the sewer either to drain water from the water line or to keep water flowing in the water main to prevent it from freezing. Backflow can occur by back siphonage when the valve is left open.



8. When a cross connection to a drain pipe exists, backflow can occur by back siphonage if the valve is left open and there is not enough air gap between the outlet of the cross connection and the drain pipe. A partial vacuum in the potable water line can draw contaminated water from the drain pipe. An example of this would be the drain line from a home water softener.



9. A cross connection can be created when a hose connection from a water line is used to fill a tanker truck. Backflow can occur by back siphonage if a partial vacuum is developed in the water system. This is what happened in the Minnesota case mentioned earlier.



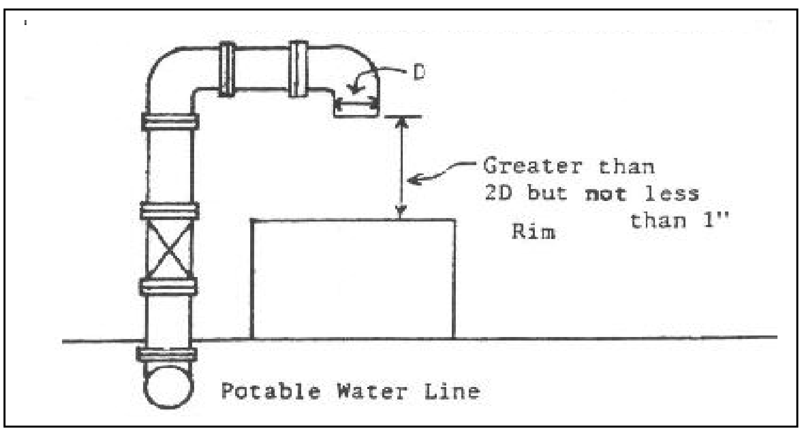
These are a few of the possible types of cross connections that can occur. The variety of possible cross connections is almost infinite, making them difficult to control.

MEANS USED TO PROTECT AGAINST CROSS CONNECTIONS

There are five basic means which are used to prevent or reduce the possibility of backflow in cross connections: air gaps, atmospheric vacuum breakers, pressure-type vacuum breaker assemblies, double check valve assemblies, and reduced-pressure backflow prevention assemblies. The latter assembly must be certified by an approved testing laboratory before being acceptable to the Minnesota Department of Health.

Air gap

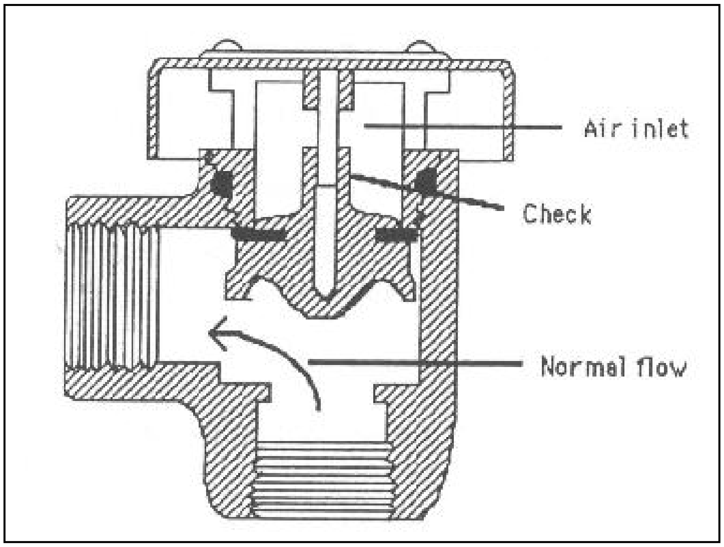
Of the five means listed, the air gap--physical separation of the potable and non potable systems by an air space--is the most reliable backflow prevention measure. The vertical distance between the supply pipe and the flood-level rim should be two times the diameter of the supply pipe, but never less than one inch. This type of backflow prevention technique can be used in situations in which potable water runs into a tank or a source which is under atmospheric pressure. Obviously, this type of backflow prevention method cannot be used for a direct connection to a pressurized system.



Atmospheric vacuum breakers

These devices do not prevent backflow due to back pressure. They must be installed on the discharge side of the last control valve. They must be installed six inches above the rim of the fixture they serve. In addition, they cannot be used under continuous pressure for a period of eight hours or more. Atmospheric vacuum breakers are usually used with hose bibs or sillcocks in situations in which a hose is attached to a sprinkler system or is draining into a tank. Once installed, atmospheric vacuum breakers cannot be tested.

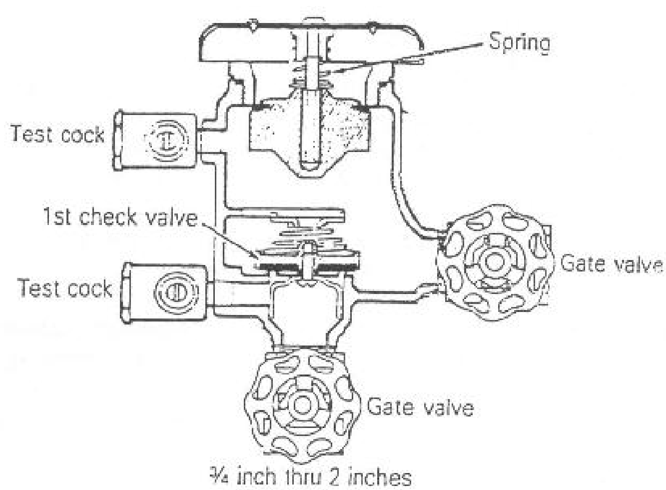
The next picture shows the operation of one type of atmospheric vacuum breaker. Under normal conditions, the gate is forced to the side, preventing air from entering. When the water system is under a partial vacuum, atmospheric pressure forces open the gate, allowing the formation of an air gap that prevents back siphonage.



Pressure-type vacuum breaker assembly

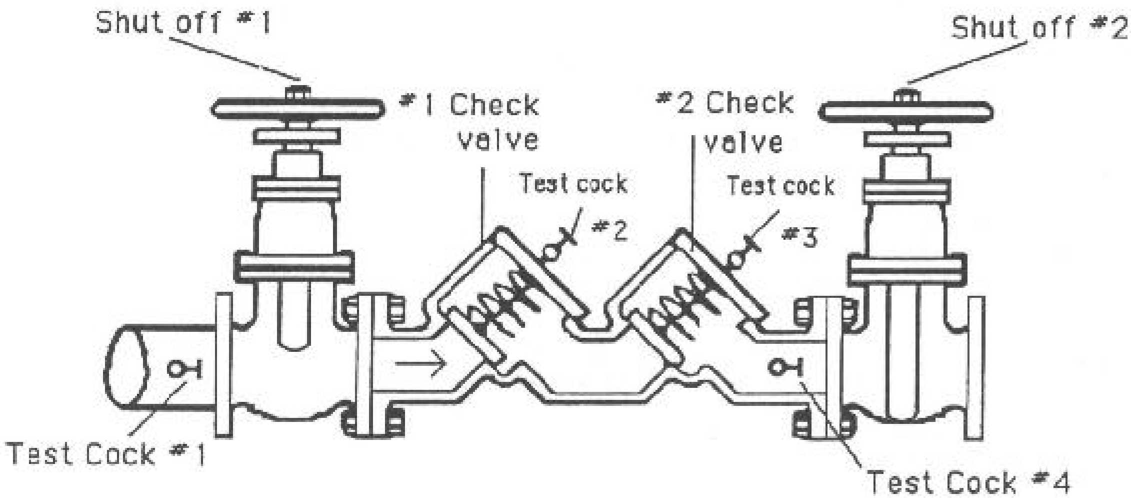
Pressure-type vacuum breaker assemblies are similar to atmospheric vacuum breakers except that these devices can be used under continuous pressure. They cannot prevent backflow due to back pressure and must be installed above the usage point to prevent back siphonage. They must be installed at least 12 inches above the rim of the device that they are protecting.

The schematic of this assembly is shown below. It is spring loaded to allow air to enter the device. Under normal conditions, water pressure compresses the spring, closing the air opening with the plunger. If a partial vacuum in the assembly is obtained, air is allowed to enter the assembly, forming an air gap. These assemblies, once installed, can still be tested.



Double checks valve assemblies

These assemblies are used for a direct connection between two potable water systems. Under continuous pressure they cannot be used to connect a potable water supply to a contaminated or high-hazard water system. The assembly, as shown, consists of two ordinary spring-loaded or internally loaded swing check valves mounted in series, two shut off valves and four test cocks. They offer only a partial degree of protection because particles can prevent proper seating of the valves causing them to leak. Double-check valve assemblies protect against back pressure and back siphonage conditions. Once installed, they can be tested.



Reduced-pressure principal backflow prevention assembly (RPZ)

This assembly provides the greatest protection against back pressure and back siphonage. The RPZ can be used under continuous pressure and in high-hazard conditions. The RPZ is designed so it will operate even if both the check valves become fouled. A reduced-pressure backflow preventer, as shown, consists of two internally loaded check valves with a zone of reduced pressure between the check valves, two shut off valves and four test cocks. The reduced-pressure chamber also has a spring-differential pressure relief valve.

Such a backflow preventer can be installed on water lines that are used to fill tank trucks. Many private facilities in communities allow farmers or others needing water to fill their tank trucks. These facilities must be inspected for approved backflow prevention devices. In addition, a city must not allow tank trucks to fill from hydrants which are not protected by backflow prevention equipment.

Normal operation of the RPZ

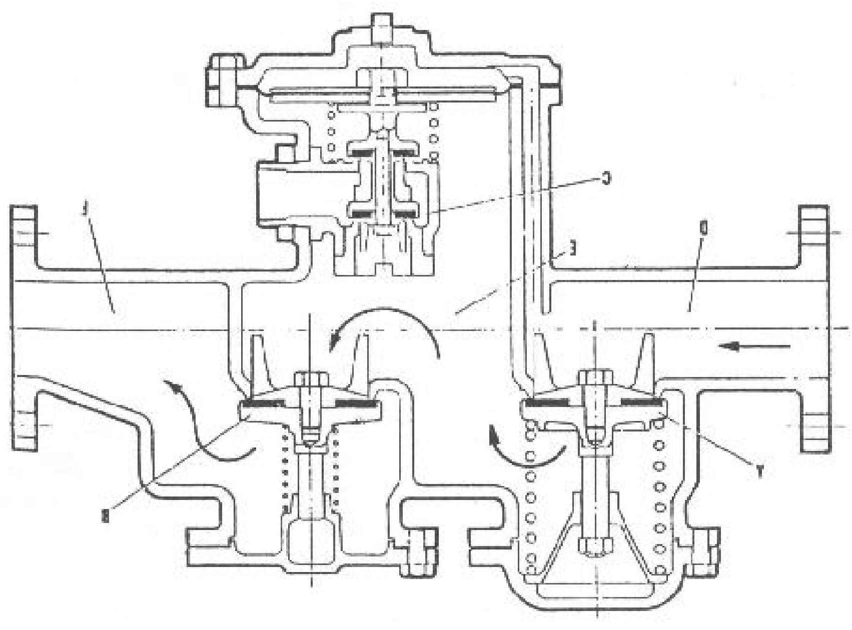
As water flows through the first check valve (A), a pressure reduction is created in the reduced-pressure chamber. The relief valve is held closed because of the reduced pressure between (D) and (E). The second check valve (B) is lightly spring-loaded to allow passage of water into (F).

During back siphonage the following occurs:

When inlet pressure in (D) drops below atmospheric pressure, the relief valve (C) is forced open by the diaphragm creating an air gap in (E). If check valve (B) is leaking, water will drain continuously from the relief valve, indicating a malfunctioning of that check valve.

During a back pressure situation the following occurs:

In the event that check valve (B) leaks, check valve (B) is closed when downstream pressure increases above influent pressure, the increased pressure in zone (E) will cause the relief valve to open and water to drain from the chamber. The relief valve does not keep the pressure in zone (E) below the pressure in zone (D) so that backflow cannot occur. If the check valve (B) does not leak, backflow will not enter the center chamber. See the attached schematics on page 320 (from Watts) on the operation of an RPZ.



NOTE: The RPZ above must be accompanied by a valve on both ends to be an approved and testable RPZ assembly.

EXCERPT FROM MINNESOTA PLUMBING CODE: 4715.2100 BACKFLOW PREVENTERS

A. Atmospheric vacuum breaker (AVB):
   1. must be installed at least six inches above spill line (see special requirements in part 4715.2150);
   2. no possibility of back pressure permitted;
   3. only permitted on discharge side of last control valve; and
   4. no more than eight hours of continuous line pressure permitted.

B. Pressure vacuum breaker (PVB):
   1. must be installed at least 12 inches above spill line;
   2. no possibility of back pressure permitted; and
   3. continuous line pressure permitted.

C. Spill-proof vacuum breaker (SVB):
   1. must be installed at least six inches above spill line;
   2. no possibility of back pressure permitted;
   3. continuous line pressure permitted; and
   4. field testable.

D. Hose connection vacuum breaker (Hose VB):
   1. required for threaded hose connections;
   2. back pressure not permitted;
   3. continuous line pressure not permitted; and
   4. any new device must be field testable.

E Double-check valve with intermediate atmospheric vent (DCVIAV):
   1. permitted for low or moderate hazard with small pipe sizes;
   2. back pressure permitted; and
   3. continuous line pressure permitted.

F. Reduced pressure zone backflow preventer assembly (RPZ):
   1. any degree of hazard permitted;
   2. back pressure permitted; and
   3. continuous line pressure permitted.

G. Double-check valve assembly (DCVA):
   1. permitted only for nontoxic, low hazard installations with nuisance or aesthetic concern;
   2. back pressure permitted; and
   3. continuous line pressure permitted.

STAT AUTH: MS s 16B.61; 326.37 to 326.45 HIST: 15 SR 76

Installation of RPZs

The following should be considered when installing a reduced-pressure principal backflow preventer:

a. In new installations it is important that the piping be thoroughly flushed.
b. Install strainers in front of the check valves to prevent foreign material from disrupting the operation of the check valves.
c. If continuous water supply is required, then two backflow preventers can be installed in parallel. Resilient seated gate valves or ball valves should be installed on

both sides of each backflow preventer so that the water supply can be maintained while the other backflow preventer can be serviced. Gate valves or ball valves are necessary for the testing of these assemblies.

d. The backflow-prevention assemblies should be installed at least 12 inches above the floor or grade and a maximum height of 72 inches. They should also be at least 12 inches out from walls or other obstacles which may interfere with testing procedures; never in a pit or manhole.

e. Because RPZs will discharge water when back pressure or back siphonage conditions occur, a drain must be provided. The RPZ also drains when the check valve is fouled.

f. The relief valve must drain through an air gap and any discharge should be clearly visible.

g. The relief valve port shall remain open.

h. The installation of reduced pressure zone backflow preventers is permitted only when periodic testing is done by a trained backflow preventer tester acceptable to the administrative authority. Inspection intervals shall not exceed one year, and records must be kept. All devices must be tested after initial installation to assure that debris from the piping installation has not interfered with the functioning of the assembly.

i. A person certified/licensed by the Minnesota Department of Health shall perform all testing and maintenance work.

Maintenance of RPZs

Backflow preventers should be inspected and tested annually and overhauled every five years. In Minnesota, this must be done by a person certified and/or licensed by the Minnesota Department of Health (MDH) to perform such work. The installation of a reduced-pressure backflow preventer shall be permitted only when there is an approved backflow testing and inspection program provided by the local administrative authority. In addition, they shall be inspected frequently after initial installation to assure that they have been properly installed and that debris resulting from the piping installation has not interfered with the functioning of the assembly.

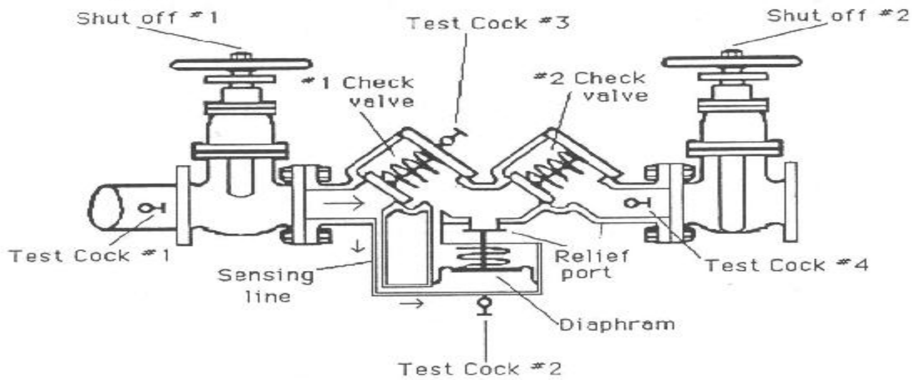
<u>Inspection records</u>
A test and inspection tag must be affixed to the assembly. The tester shall date and sign the tag and include his or her backflow preventer tester identification number. Written records of testing and maintenance must be maintained and submitted to the administrative authority. Any backflow preventer that is testable and in service should be placed on a service-maintenance schedule.

The testing and maintenance of the assembly shall be preformed by a certified tester. Backflow-tester identification numbers are issued by the MDH after qualified schooling. In a municipality with a population over 5000, the tester also has to be a licensed plumber. A chart comparing the different types of backflow-preventers is attached.

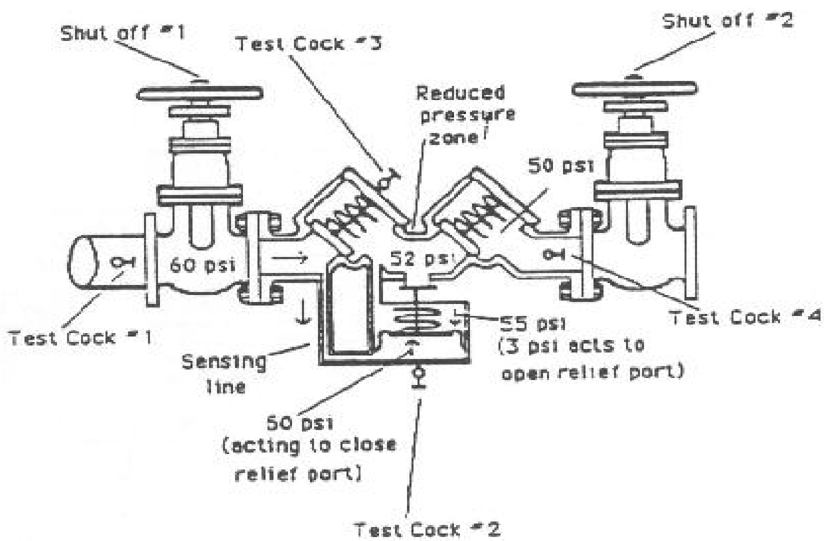
Four basic types of backflow preventers and their uses

Type & Purpose	Description	Installed At	Examples of Installations
1. REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER For high hazard cross connections.	Two independent check valves with intermediate relief valve. Supplied with shut-off valves and ball type test cocks.	All cross connections subject to backpressure or backsiphonage where there is a high potential health hazard from contamination. Continuous pressure.	Main Supply Lines: Commercial Boilers; Cooling Towers; Hospital Equipment; Processing Tanks; Laboratory Equipment; Waste Digesters; Car Wash; Sewage Treatment
2. DOUBLE CHECK VALVE ASSEMBLY For low hazard cross connections.	Two independent check valves. Supplied with shut-off valves and ball type test cocks.	All cross connections subject to backpressure where there is low potential health hazard or nuisance. Continuous pressure.	Main Supply Lines: Food Cookers; Tanks & Vats; Lawn Sprinklers; Fire Sprinkler Lines; Commercial Pools (Nontoxic)
DOUBLE DETECTOR CHECK VALVE ASSEMBLY For low hazard applications.	Double check valve assembly with a water meter and double check in by-pass line.	Fire protection system supply main. Detects leaks and unauthorized use of water.	Fire Sprinkler Lines (Nontoxic)
DUAL CHECK VALVE BACKFLOW PREVENTER For low hazard applications.	Two independent check valves. Checks are removable for testing.	Cross connections where there is a low potential health hazard & moderate flow requirements.	Residential Supply Lines (at the meter) (Nontoxic)
3. BACKFLOW PREVENTER WITH INTERMEDIATE ATMOSPHERIC VENT For moderate hazard cross connections in small pipe sizes.	Two independent check valves with intermediate vacuum breaker and relief valve.	Cross connections subject to backpressure or back-siphonage where there is a moderate health hazard. Continuous pressure.	Boiler (Small); Cooling Towers (Small); Dairy Equipment; Residential
		Pump outlet to prevent backflow of carbon dioxide gas and carbonated water into the water supply system to beverage machines.	Post-Mix Carbonated Beverage Machine
LABORATORY FAUCET and DOUBLE CHECK VALVE with INTER-MEDIATE VACUUM BREAKERS In small pipe sizes For moderate to low hazard.	Two independent check valves with intermediate vacuum breaker and relief valve.	Cross-connections subject to backpressure or back-siphonage where there is a moderate to low health hazard.	Laboratory Faucets and Pipe Lines; Barber Shop and Beauty Parlor Sinks
4. ATMOSPHERIC VACUUM BREAKERS For moderate to high hazard cross connections.	Single float and disc with large atmospheric port.	Cross connections not subject to backpressure or continuous pressure. Install at least 6" above fixture rim. Protection against backsiphonage only.	Process Tanks; Dishwashers; Soap Dispensers; Washing Machines; Lawn Sprinklers.
PRESSURE TYPE VACUUM BREAKERS For moderate to high hazard cross connections.	Spring loaded single float and disc with independent 1st check. Supplied with shut-off valves & ball type test cocks.	This valve is designed for installation in a continuous pressure potable water supply system 12" above the over-flow level of the system being supplied. Protection against backsiphonage only.	Laboratory Equipment; Cooling Towers; Comm. Laundry Machines; Swim-ming Pools; Chemical Plating Tanks; Lg. Toilet & Urinal Facilities; Degreasers; Photo Tanks; Live Stock Water Systems; Lawn Sprinklers
HOSE CONNECTION VACUUM BREAKERS For residential & industrial hose supply outlets.	Single check with atmospheric vacuum breaker vent.	Install directly on hose bibbs, service sinks & wall hydrants. Not for continuous pressure.	Hose Bibbs; Service Sinks; Hydrants.

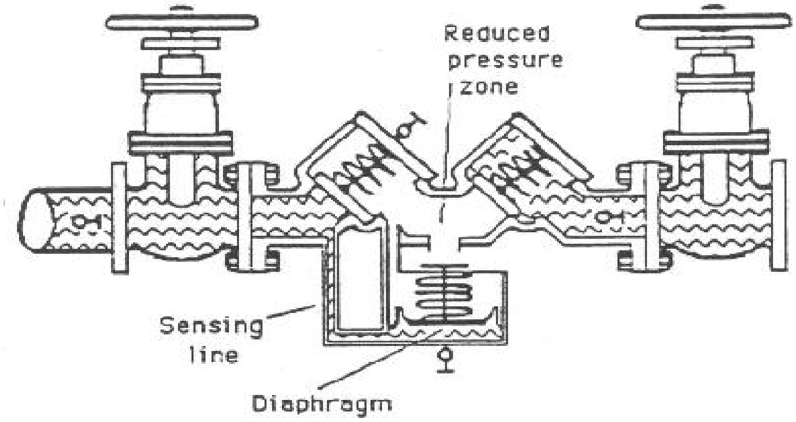
Watts Regulator - Schematics on the operation of RPZ



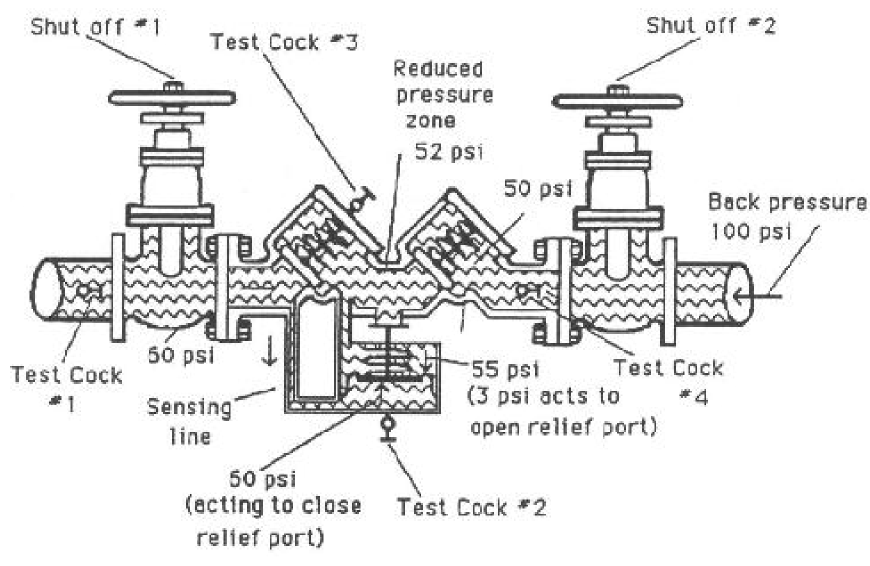
Reduced Pressure Principle Assembv. This backflow preventer is also frequently called a Reduced Pressure Zone Assembly. (RPZ)



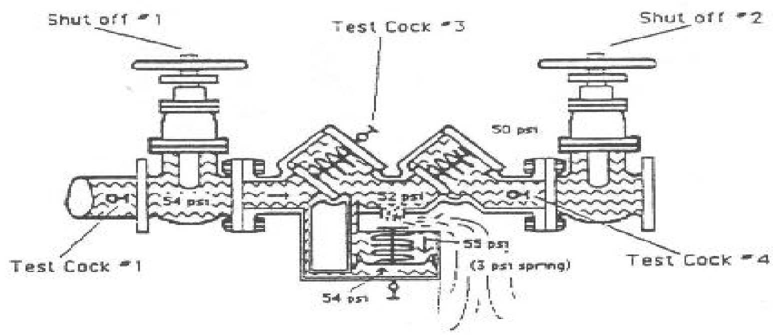
RPZ Under Normal Flow. Assume a supply pressure of 60 psi and a pressure reduction by the first check valve of 8 psi, creating a pressure of 52 psi in the reduced pressure zone. If the relief valve has a 3 psi spring, the pressure working to open the port would be 55 psi (52 psi + 3 psi) and the pressure working to keep the port closed is 60 psi. Thus under normal flow conditions, the relief valve remains open.



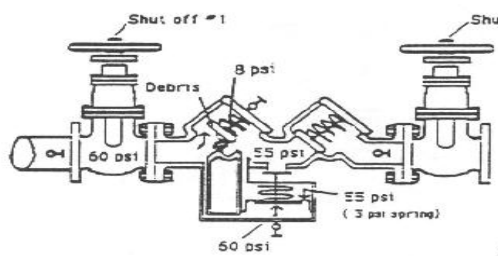
Leaking RPZ. Under special condition during backsiphonage, the relief valve will open, all the water in the reduced pressure zone "dumps", creating an air gap between check valve #1 and check valve #2.

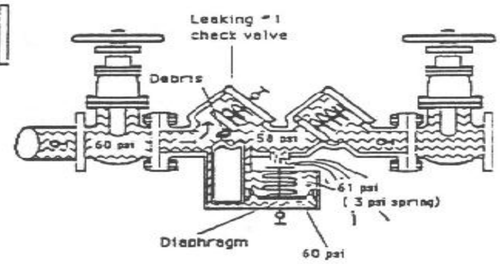


RPZ during Back Pressure Conditions. Assume a supply pressure of 60 psi, a relief valve spring pressure of 3 psi, a spring pressure of 8 psi for the first check valve and back pressure from the downstream side of 100 psi. If the second check valve is working properly the pressure in the reduced pressure zone will not increase.

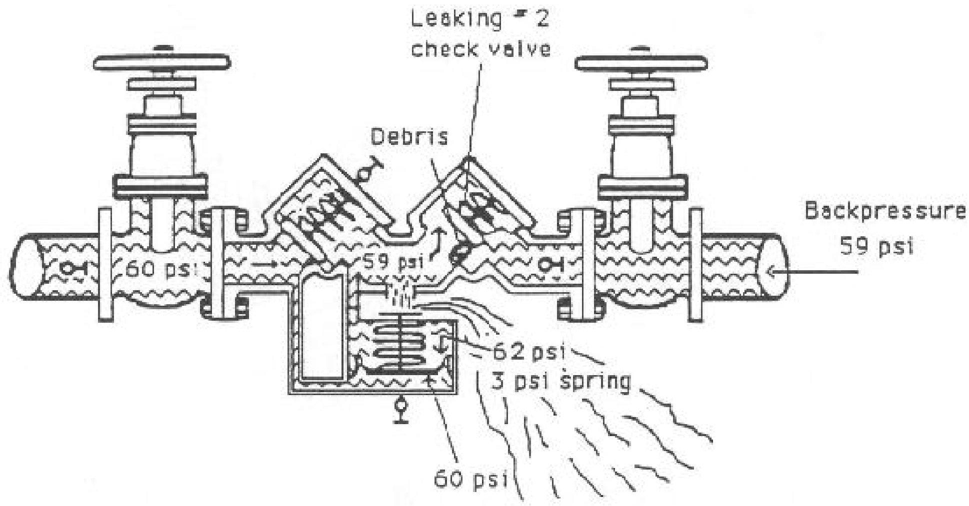


<u>RPZ during Backsiphonage Conditions</u>. The supply pressure falls to 54 psi (perhaps because the lines are being flushed). Because the assembly is under static conditions, the pressure in the zone will remain at 52 psi (since the first check prevents backflow or water out of the zone and the second check will not allow water in the zone to move downstream until there is a demand for water from the customer). The pressure of 52 psi within the zone combined with the pressure exerted by the spring, 3 psi, will cause the relief valve to open and dump the water in the zone.

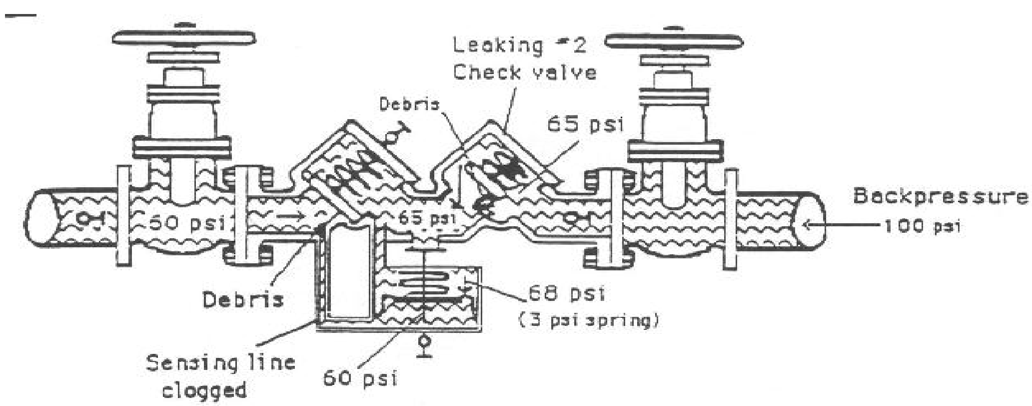




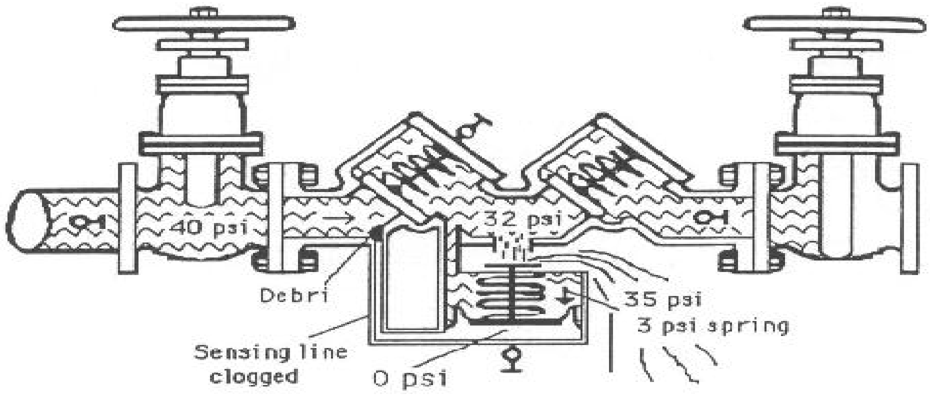
<u>RPZ Failing First Check Valve</u>. Under normal flow conditions, the pressure inside the zone is 52 psi and the pressure acting to open the relief valve is 55 psi. If the first check fails, the pressure inside the zone will increase toward 60 psi. When the pressure inside the zone reaches 58 psi, the total pressure acting to open the diaphragm is 61 psi. This is sufficient pressure to open the relief valve and continuously dump water from the zone.



RPZ Failing Second Check Valve During Back Pressure Conditions. If a pump connected to the consumer's potable water line creates a pressure of 59 psi and the second check valve is leaking, the pressure acting to open the relief valve is 62 psi (59 psi + 3 psi), while the pressure acting to keep it closed is only 60 psi. Therefore, the relief valve will open.



RPZ with Clogged Sensing Line Under Back Pressure Conditions. Assume a static condition, a first check spring pressure of 8 psi, a relief valve spring pressure of 3 psi, a supply pressure of 60 psi, and a pressure of 60 psi trapped in the sensing line. If the second check valve leaked during back pressure conditions and the pressure in the zone increased to 100 psi, the relief valve will not open even though the pressure working to open the relief valve (65 psi) is greater than the pressure supplied by the sensing line (60 psi), because water inside the sensing line cannot be compressed. The diaphragm cannot move to allow the relief valve to open.



RPZ with Clogged Sensing Line with 0 psi in the Sensing Line. The pressure inside the zone is 32 psi, and the pressure acting to open the relief valve is 35 psi. If the sensing line is clogged and the pressure acting to keep the relief valve closed is 0 psi, the relief valve will open and continue to dump water from the zone until the sensing line is cleared allowing water pressure to the upstream side of the diaphragm.

CROSS CONNECTION CONTROL PROGRAMS

The protection of a potable water supply from becoming contaminated from cross connections is the duty of the city's public health staff, water works managers, maintenance personnel, building managers, and plumbing inspectors and installers. The duties include the design, evaluation, installation, and maintenance of the piping systems. Those responsible for inspecting plumbing should insist on protection against backflow. Plumbers and maintenance personnel should follow codes and ordinances to eliminate, or reduce the chances of backflow. Any defects found should be reported in writing to those in charge and those defects corrected as soon as possible.

WHAT SHOULD BE DONE TO CONTROL CROSS CONNECTIONS

Water works operators and superintendents should be knowledgeable of any cross connections in their own and their customers' distribution systems. They should develop a sound program that eliminates health hazards caused by cross connections. Often, hazards can be prevented by a simple air gap or backflow prevention device. Air gaps are, of course, the best measure to use when there is potential for a cross connection to an extreme hazard.

Some general programs for a city's water distributions system are:

1. Elimination or protection of direct connections between potable and non-potable systems.
2. Elimination of private well connections to public water supplies.
3. Design of piping systems in the potable water distribution systems so that enough water at the desired pressure is always available.

4. Staying alert during a large fire for possible problems with low-pressure areas when water pressure may be reduced in the distribution system.
5. Repair water main breaks immediately. A large pressure drop in the entire system can occur when a water main breaks.

Priority

A plan of action should first concentrate on the complete removal of cross connections, based on the degree of the hazard involved. All cross connections between a potable water supply and a piping system conveying or containing sewage, toxic or hazardous chemicals, or non-potable sources should be eliminated.

Second, plumbing defects and cross connections should be eliminated by an on-going instructional program in plumbing repair. The city needs to oversee plumbing operations.

Third, unused or obsolete fixtures having inlets ending below the overflow level should be eliminated. Although lower in priority, fixtures with inlets below the flood level rim should be equipped with vacuum breakers. If a vacuum preventer is not provided, low amounts of low hazardous water may be siphoned into the potable water supply. The priority depends on the degree of hazard, volume of water, and number of people affected. A careful study of actions is needed to rate the priorities.

4715.2110 TYPES OF DEVICES REQUIRED WHERE AN AIR GAP CANNOT BE PROVIDED.[1]

					Only allowed where no back pressure is possible		
		RPZ	DCV IAV	DCVA	SVB or PVB	AVB	Hose VB
A.	Boiler, other than one- or two-family residential	X					
B.	Boiler, one- or two-family residential	X	X				
C.	Car wash	X			X	X	
D.	Carbonated beverage machine (postmix) (see part 4715.2163)		X				
E.	Chemical line	X					
F.	Chemical tank	X			X	X	
G.	Chiller	X					
H.	Cooling tower	X	X		X	X	
I.	Dental units (separate assembly required for each unit)	X					
J.	Dishwasher, commercial				X	X	
K.	Fire sprinkler system[2]	X	X	X			
L.	Flush tank (water closet, urinal, similar) (see part 4715.2150)	X			X	X	
M.	Flush valve (water closet, urinal, similar) (see part 4715.2150)	X			X	X	
N.	Food and beverage equipment or system	X	X	X	X	X	
O.	Garbage can washer	X			X	X	
P.	Glycol or other antifreeze system	X					
Q.	Lab equipment	X			X	X	
R.	Lab faucet					X	
S.	Laundry machine, commercial	X	X		X	X	

T.	Lawn, garden or greenhouse sprinkler system	X			X	X	
U.	Operating, dissection, embalming or mortuary table (see part 4715.1950)	X			X	X	
V.	Private potable water supply (where permitted by administrative authority)	X	X	X			
W.	Private nonpotable water supply (where permitted by administrative authority)	X					
X.	Process line	X	X				
Y.	Process tank	X			X	X	
Z.	RV dump station	X	X		X	X	
AA.	Sewage treatment	X			X	X	
BB.	Soap dispenser	X	X		X	X	
CC.	Swimming pool, fountain, pond, baptistry, aquarium or similar	X	X		X	X	
DD.	Threaded hose connections, including: hose bibbs, hydrants, service sinks, laundry trays					X[3]	X
EE.	Truck fill	X			X	X	
FF.	Vacuum systems or aspirators	X			X	X	

1. For installations not listed in this part, review with the Administrative Authority.

2. Installations must comply with AWWA-M14, chapter 6 (1990) except that the following statement is deleted from section 6.3: At any time where the fire sprinkler piping is not an acceptable potable water system material, there shall be a backflow-prevention assembly isolating the fire sprinkler system from the potable water system.

3. A vacuum breaker installed as an integral part of a product approved to a standard does not require additional backflow prevention on the hose threads; the product must be constructed so that if the integral backflow preventer is removed, the remaining threads will not be hose thread type. An unprotected threaded hose connection must be protected against backflow by addition of a backflow preventer complying with ASSE 1052.

Statutory Authority: *MS s 16B.59 to 16B.75; 326.37 to 326.45; 326B.101 to 326B.194; 326B.43 to 326B.49*

History: *15 SR 76; 19 SR 590; 23 SR 686; 28 SR 146; L 2007 c 140 art 4 s 61; art 6 s 15; art 13 s 4; L 2008 c 337 s 64*

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