COLLEGE TOWNSHIP WATER AUTHORITY

College Township Building
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BACKFLOW PREVENTION MANUAL

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INTRODUCTION

The College Township Water Authority (Authority) provides municipal water service to over 2,400 customers in College Township, Pennsylvania. The Authority's system is comprised of well water supplies, storage facilities and a water distribution network that delivers potable water to its customers.

The Department of Environmental Protection (DEP) is authorized under the Pennsylvania Safe Drinking Water Act to establish standards for the construction of a water supply to assure compliance with the provisions of the act. Accordingly, Section 109.608 of DEP's rules and regulations, requires that "a public water system may not be designed or constructed in a manner which creates a cross-connection." In addition, Section 109.709(b) further requires that "At the direction of DEP, the public water supplier shall develop and implement a comprehensive control program for the elimination of existing cross-connections or the effective containment of sources of contaminations, and prevention of future cross-connections."

Precautions must be taken to be certain that the water in the Authority distribution system is not contaminated by other sources. Such a contamination can occur through "cross-connections" which can cause a backflow of contaminated water to enter the public distribution system. This Backflow Prevention Manual is designed to work with customers and prevent possible contamination originating on the customer's premises from entering and degrading the public distribution system. The responsibility for cross-connection control does not rest solely or mainly with the Authority. The customer has a significant and primary legal duty to prevent contamination originating on their property from jeopardizing the public health of other customers dependent upon the distribution system for drinking water supply.

College Township has adopted the 1996 BOCA Building and Plumbing Codes. Backflow prevention devices shall be installed in conformance with this Manual, the Authority's Rules and Regulations; the Authority's Standard Specifications, and the BOCA Plumbing Code as applicable. The Policy and Procedures, as outlined herein, along with other applicable codes, rules, and regulations, are designed to provide reasonable protection of the Authority's potable water supply system against contamination and/or pollution resulting from backflow through uncontrolled pluming connections and/or cross-connections.

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Section 1.0 General Policy

1.1 To recognize that customer plumbing systems may contain non-potable liquids, may have connections to apparatus, vessels, etc., that could have impurities in varying degrees and, if not properly controlled and contained, could contaminate or pollute both the customer's internal water system and the public potable water supply system. It is also the intent to apply the principle that the type of protection required shall be determined by whether the impurities are hazardous or nonhazardous.

1.2 The purpose of this Manual is:

a. To protect the College Township Water Authority's (Authority) public water supply from contamination or pollution by isolating, within the consumer's water system, contaminants or pollutants which could back-flow through the service connection into the public water supply system.

b. To promote the elimination or control of existing cross-connections, actual or potential, between the Authority's or consumer's water supply and non-potable water systems, plumbing fixtures and sources or systems containing process fluids.

c. To provide for the maintenance and continuation of a cross-connection control program which prevents the contamination or pollution of the Authority's and consumer's water supply.

1.3 The Authority and the consumer have the joint responsibility for protection of the public water supply from contamination or pollution due to backflow. If the Authority requires an approved backflow prevention device, the Authority shall give notice to the consumer to install such an approved backflow prevention device at each service connection to their premises. The consumer should immediately install such an approved device or devices at their own expense. Failure, refusal, or inability on the part of the consumer to install such a device or devices shall constitute grounds for discontinuing water service to the premises until such a device or devices have been installed.

Section 2.0 Definitions

2.1 **Air Gap Separation** - The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying potable water to a tank, plumbing fixture, or other device and the flood level rim of the receptacle. The differential distance shall be at least double the diameter (2 x D) of the supply pipe measured vertically above the top of the rim of the vessel. In no case, shall the air gap be less than one inch.

2.2 **Approved** - A backflow prevention device or method that has been accepted by the Authority as suitable for the proposed use.

2.3 **Atmospheric Vacuum Breaker (AVB**) - A fixture outlet device containing an optional shutoff valve followed by a valve body containing a soft-seated float-check, a check seat and an air inlet port. If the shutoff valve is open, the flow of water causes the float to close the air inlet port. If the shutoff valve is closed, the float falls and forms a check valve against backsiphonage and at the same time opens the air inlet port. If no shutoff valve is provided, the flow of water will determine the opening and closing of the air inlet port.

2.4 **Auxiliary Water System -** Any water source or system on the premises of, or available to, the customer except connections to other approved community water supply systems.

2.5 **Backflow** - A flow condition, induced by a differential in pressure, that causes the flow of water or mixtures of water and other substances into the distribution pipes of a potable water supply system from a source other than its intended source. Backflow can result from either backsiphonage or backpressure.

2.6 **Backflow Preventer** - A device or other means which will prevent the backflow of water or any other substance into the public water supply system.

2.7 **Backpressure** - The backflow of water or a mixture of water and other substances from a plumbing fixture or other customer source, into a public water supply system due to an increase of pressure in the fixture or customer source to a value that exceeds the system pressure.

2.8 **Backsiphonage** - The backflow of water or a mixture of water and other substances from a plumbing fixture or other customer source, into a public

water supply system due to a temporary negative or sub-atmospheric pressure within the public water supply system.

2.9 **Consumer -** The owner or person in control of any premises supplied by or in any manner connected to a public water supply system.

2.10 **Consumer's Water System** - Any water system, located on the consumer's premises, supplied by or in any manner connected to a public water supply system. A household plumbing system is considered to be a consumer's water system.

2.11 **Containment** - Cross-connection control which isolates the customer's entire facility from the public water supply system so as to provide the protection necessary to prevent contamination of the public water supply in the event of backflow from the customer's facility. Though containment control prevents contamination of the public water supply, it offers no protection to the water distribution system within the facility. Reduced pressure zone devices are used for containment control.

2.12 **Contamination** - The degradation of the quality of the drinking water by wastewaters, processed fluids, or any water of a quality less than accepted drinking water quality to a degree which would create an actual hazard to the public health through poisoning or through the spread of disease.

2.13 **Cross-connection** - An arrangement allowing either a direct or indirect connection through which backflow, including backsiphonage, can occur between the drinking water in a public water system and a system containing a source or potential source of contamination, or allowing treated water to be removed from any public water system, used for any purpose or routed through any device or pipes outside the public water system, and returned to the public water system. The term does not include connections to devices totally within the control of one or more public water systems and connections between water mains.

2.14 **Degree of Hazard** - An evaluation of the potential risk to health and the adverse effect upon the public water supply system.

2.15 **Double Check Valve Assembly (DCVA**) - An assembly composed of two single, independently acting, soft-seated, spring-loaded check valves including tightly closing shutoff valves located at each end of the assembly and suitable connections for testing the water tightness of each check valve.

2.16 **Fixture Outlet Protection** - Cross-connection control which isolates all free-flowing fixture outlets (i.e., faucets) from the water distribution system within a facility. Fixture outlet protection prevents backflow contamination of both

the facility water system and the public water supply. Examples of fixture outlet protection devices include atmospheric vacuum breakers, hose-bibb vacuum breakers, and pressure vacuum breakers.

2.17 **Health Hazard** - Any condition, device, or practice in a water system or its operation that creates, or may create, a danger to the health and well-being of its users. The word “severe”, as used to qualify “health hazard”, means a hazard to the health of the user that could reasonably be expected to result in significant morbidity or death.

2.18 **Hose-Bibb Vacuum Breaker (HBVB)** - A fixture outlet device which contains a soft-seated, spring-loaded, air inlet valve and is designed to be attached to an outlet having a hose connection thread.

2.19 **Interchangeable Connection** - An arrangement or device that will allow alternate, but not simultaneous, use of two sources of water.

2.20 **Internal Protection** - Cross-connection control which isolates all non-outlet, water-use appliances within a facility (e.g., kitchen appliances, air conditioners, boilers, process tanks, photo developing equipment) from the water distribution system within the facility. Internal protection prevents backflow contamination of both the facility water system and the public water supply. Reduced pressure zone devices and double check valve assemblies are used for internal protection.

2.21 **Non-Health Hazard** - Any condition, device or practice in a water system or its operation that creates, or may create, an impairment of the quality of the water to a degree which does not create a hazard to the public health, but which does adversely and unreasonably affect the aesthetic qualities of such water for domestic use.

2.22 **Non-Potable Water** - Water not safe for drinking, personal, culinary, or any other type of domestic use.

2.23 **Person** - Any individual, partnership, association, company, corporation, municipality, municipal authority, political subdivision or any agency of federal or state government. The term includes the officers, employees and agents of any partnership, association, company, corporation, municipality, municipal authority, political subdivision or any agency of federal or state government.

2.24 **Pollution** - The presence in water of any foreign substance that tends to degrade its quality so as to constitute a hazard, or to impair the usefulness or quality of the water to a degree which does not create an actual hazard to the

public health, but which does adversely and unreasonably affect such waters for domestic use.

2.25 **Potable Water -** Water which is satisfactory for drinking, personal, culinary, and domestic purposes and meets the requirements of DEP.

2.26 **Pressure Vacuum Breaker (PVB)** - A fixture outlet device containing an independently operating, soft-seated, spring-loaded check valve and an independently operating, soft-seated, spring-loaded, air inlet valve on the discharge side of the check valve.

2.27 **Public Water Supply System -** A system which provides water to the public for human consumption which has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. The term includes any collection, treatment, storage, and distribution facilities under control of the operator of the system and used in connection with the system. The term includes collection or pretreatment storage facilities not under such control, which are used in connection with the system. The term also includes a system which provides water for human consumption via bottling, vending machines, retail sale, or bulk hauling methods.

2.28 **Reduced Pressure Zone Device (RPZD)** - A device which contains two independently acting, soft-seated, spring-loaded check valves, together with a soft-seated, spring-loaded, diaphragm-activated, pressure differential relief valve located between the two check valves. During normal flow and at the cessation of normal flow, the pressure between these two checks shall be less than the supply pressure. In case of leakage of either check valve, the differential relief valve, shall maintain the pressure between the checks at less than the supply pressure by opening to the atmosphere. The device must include tightly closing shutoff valves located at each end, and each device shall be fitted with properly located test cocks.

2.29 **Residential Dual Check Valve (RDCV)** - A non-testable backflow prevention device that is used for containment control of residential homes and consists of two independently operating, soft-seated, spring-loaded, consecutive check valves.

2.30 **Service Connection -** The terminal-end of a service line from the public water supply system. If a meter is installed at the end of the service line, then the service connection means the downstream end of the meter.

2.31 **System Hazard** - A condition posing an actual or potential threat of damage to the physical properties of the public water system or to the consumer's potable water system.

Section 3.0 CTWA Water System

3.1 The water system shall be considered as made up of two parts: the Authority's water supply system and the consumer's water system.

3.2 The Authority's water supply system shall consist of the source facilities and the distribution system, and shall include all those facilities of the public water supply system under the control of the Authority up to the point where the consumer's water system begins.

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

3.4 The Authority's distribution system shall include the network of conduits used for delivery of water from the source to the consumer's water system.

3.5 The consumer's water system shall include all facilities beyond the service connection, which are utilized in conveying water from the Authority's distribution system to points of use.

Section 4.0 Cross-Connections Prohibited

4.1 No water service connection shall be installed or maintained to any premises where actual or potential cross-connections to the Authority's system or consumer's water system may exist, unless such cross-connections are abated or controlled to the satisfaction of the Authority.

4.2 No connection shall be installed or maintained whereby water from an auxiliary water supply may enter the Authority's or consumer's water system unless such auxiliary water supply, as well as the method of connection and use of such supply, has been approved by the Authority.

Section 5.0 Surveys and Investigations

5.1 The consumer's premises shall be open at all times to the Authority, or its authorized representative, for the purposes of surveying for, or investigating, actual or potential cross-connections.

5.2 On request by the Authority, the consumer shall furnish information on water use practices within their premises.

5.3 It shall be the responsibility of the water consumer to conduct periodic surveys of water use practices on his/her premises to determine whether there are actual or potential cross-connections to his/her water system.

Section 6.0 Where Protection is Required

6.1 An approved backflow prevention device shall be installed prior to the first branch line leading off each service line to a consumer's water system where, in the judgement of the Authority, an actual or potential hazard to the public water supply system exists.

6.2 An approved backflow prevention device shall be installed on each service line to a consumer's water system in the Authority service area.

6.3 An approved reduced pressure zone device shall be installed on each service line to a consumer's water system serving, but not necessarily limited to, the following types of facilities unless the Authority determines that no actual or potential hazards to the public water supply system exist:

a. hospitals, mortuaries, clinics, nursing homes;
b. laboratories;
c. sewage treatment plants, sewage pumping station or storm water pumping station;
d. food or beverage processing plants;
e. chemical plants;
f. metal plating industries;
g. petroleum processing or storage plants;
h. laundries;
i. customers with an auxiliary water system;
j. car wash or truck wash; or
k. others specified by the Authority.

Section 7.0 Type of Protection Required

7.1 The type of protection required under Section 6.1, 6.2, and 6.3 of this Manual shall depend on the degree of hazard which exists as follows:

a. A Residential Dual Check valve (RDCV) shall be for containment protection at residential homes. The RDCV prevents backflow caused by both backsiphonage and backpressure,but is recommended only for residential homes which are considered to be a nonhealth hazard.

b. An approved double check valve assembly shall be installed where the Authority's water supply system may be polluted with substances that would be objectionable but not dangerous to health. An approved double check valve assembly shall be the minimum backflow prevention device installed on a service line to a customer's water system in the Authority's service Area.

b. An approved reduced pressure zone device shall be installed where the Authority's water supply system may be contaminated with a substance that could cause a system or health hazard.

c. An approved gap separation shall be installed where the Authority's water supply system may be contaminated with substances that are dangerous to public health and could cause a severe health hazard, and where such a device would be technically feasible and/or practical. The need for the installation of an air gap separation between the Authority's water supply system and the customer's water system shall be determined by the Authority on a case by case basis.

7.2 The table in Appendix A outlines the applicability of the air gap, RDCV, RPZD, and DCVA for the protection of the Authority's water supply.

Section 8.0 Backflow Prevention Devices

8.1 Any backflow prevention device required by this Manual shall be of a model or construction approved by the Authority and shall comply with the following:

a. A residential dual check valve uses two compact check modules. The dual check backflow preventer shall meet the domestic requirements of ANSI/ASSE Standard 1024.

b. A double check valve assembly or a reduced pressure zone device shall be approved by the Authority and shall mean a device that has been manufactured in full conformance with standards established by the American Water Works Association (AWWA) entitled:

ANSI/AWWA C510 Standard for Double Check Valve Backflow-Prevention Assembly; and

ANSI/AWWA C511 Standard for Reduced-Pressure Principle Backflow-Prevention Assembly.

Said AWWA standards are herein adopted by the Authority. Final approval, however, of the reduced pressure zone device and the double check valve assembly shall be evidenced by a certificate of full approval, issued by an approved testing laboratory, certifying full compliance with the AWWA standards.

b. Air gap separation to be approved shall be at least twice the diameter of the supply pipe, measured vertically above the top rim of the receiving vessel, but in no case less than one inch.

8.2 Existing backflow prevention devices approved by the Authority at the time of installation and properly maintained shall, except for inspection and maintenance requirements, be excluded from the requirement of Section 8.1 of this Manual provided the Authority is assured that they will satisfactorily protect the public water supply system. Whenever the existing device is moved from the present location, or requires more than minimum maintenance, or when the Authority finds that the maintenance of the device constitutes a hazard to health, the device shall be replaced by a backflow prevention device meeting the requirements of this Manual.

Section 9.0 Installation

9.1 Backflow prevention devices required by this Manual shall be installed at a location, and in a manner, approved by the Authority. The device(s) shall be installed by a person properly qualified. Installation of the devices shall be at the expense of the water consumer.

9.2 Installation shall be consistent with the 1996 BOCA Code as applicable.

9.3 Backflow prevention devices installed on the service line to a consumer's water system shall be located on the consumer's side of the water meter, as

close to the meter as is reasonably practical, and prior to any other connection. Refer for Rules and Regs

9.4 Pits or vaults shall be water-tight, flood-free, and maintained free from standing water by means of either a sump and pump or a suitable drain. Such a pump or drain shall not connect to a sanitary sewer, nor permit flooding of the pit to day light or vault by reverse flow from its point of discharge. An access ladder and adequate lighting, natural or artificial, shall be provided to permit maintenance, inspection, and testing of the backflow prevention device.

Section 10.0 Inspection and Maintenance

10.1 It shall be the duty of the consumer at any premises on which backflow prevention devices are required by this Manual to have inspections, tests, and overhaul made in accordance with the following schedule, or more often where inspections indicate a need.

a. Double check valve assemblies shall be inspected and tested for tightness at the time of installation. These devices shall be dismantled, inspected internally, cleaned, and repaired whenever needed.

b. Reduced pressure zone devices shall be inspected and tested for tightness at the time of installation, and at least every 12 months thereafter. These devices shall be dismantled, inspected internally, cleaned, and repaired whenever needed and at least every five years.

c. Air separation shall be inspected at the time of installation, and at least every 12 months thereafter.

d. Interchangeable connections shall be inspected at the time of installation, and at lease every 12 months thereafter.

10.2 Inspections, tests, and overhaul of backflow prevention devices shall be made at the expense of the water consumer, and shall be performed by the Authority or a person certified to inspect, test, and overhaul backflow prevention devices.

10.3 Whenever backflow prevention devices required by this Manual are found to be defective, they shall be repaired or replaced at the expense of the consumer without delay.

10.4 The water consumer must maintain a complete record of each backflow prevention device from purchase to retirement. This shall include a comprehensive listing that includes a record of all tests, inspections, and repairs. Records of inspections, tests, repairs, and overhaul shall be submitted to the Authority upon request.

10.5 Backflow prevention devices shall not be bypassed, made inoperative, removed, or otherwise made ineffective without specific authorization by the Authority.

Section 11.0 Booster Pumps

11.1 Where a booster pump has been installed on the service line to, or within, any premises, such a pump shall be equipped with a low pressure cut-off device designed to shutoff the booster pump when the pressure in the service line on the suction side of the pump drops to 10 pounds per square inch gauge or less for a period of 30 seconds or longer.

11.2 It shall be the duty of the water consumer to maintain the low pressure cut-off device in proper working order and to certify to the Authority, at least once a year, that the device is operating properly.

Section 12.0 Violations

12.1 The Authority may deny or discontinue, after issuing reasonable notice, the water service to any premises wherein any backflow prevention device required by this Manual is not installed, tested, and maintained in a manner acceptable to the Authority, or if it is found that the backflow prevention device has been removed or by-passed, or if an unprotected cross-connection exists on the premises, or if a low pressure cut-off device required by this Manual is not installed and maintained in working order.

12.2 Water service to such premises shall not be restored until the consumer has corrected or eliminated such conditions or defects in conformance with this Manual and to the satisfaction of the Authority.

Appendix A
Recommended Backflow Prevention Devices

	Application	Type of device to be used		
		Dual Check Valve	Double Check Valve Assembly	Reduced Pressure Zone Assembly
1.	Standard Single Family	X		
2.	w/ closed loop geo-thermal system	X		
3.	w/ open loop geo-thermal system		X	
4.	w/ on-site well		X	
5.	w/ alternate well source		X	
6.	w/ underground sprinkler system		X	
7.	w/ water powered sump pump		X	
8.	Apartments (four or less units)	X		
9.	Apartments (five or more units)		X	
10.	Automatic Car Wash			X
11.	Automated Manufacturing Plants			X
12.	Auxiliary Water Systems			X
13.	Beverage Bottling Plants		X	
14.	Breweries/Distillers			X
15.	Chemical Plants Manufacturing, Processing, Compounding, or Treatment			X
16.	Dairies and Cold Storage Plants			X
17.	Dye Works			X
18.	Film Processing			X
19.	Irrigation Systems Green House, Park, Golf			X

	Course, Playgrounds, Estates, Cemeteries, etc.)			
20.	Laboratories			X
21.	Laundries			X
22.	Meat Packing and Rendering Plants			X
23.	Metal Plating Plants			X
24.	Paper and Paper Products (Wet Process)			X
25.	Petroleum or Gas Processing or Storage Plants			X
26.	Plating Plants			X
27.	Power Plants (Heating, Ventilation, Refrigeration, or Commercial Power)			X
28.	Rubber Plants Natural or Synthetic, Mfg. Rubber Goods or Tires)			X
29.	Sand and Gravel Plant			X
30.	Sewage or Stormwater Treatment/Processing Facility; Ejector or Pumping Station			X
31.	Swimming Pools		X	
32.	Water Front Facilities and Industries			X

	Application	**Type of device to be used**		
		Dual Check Valve	**Double Check Valve Assembly**	**Reduced Pressure Zone Assembly**
34.	Radioactive Materials or Substances, Processing Plants or Facilities Handling			X
35.	Manufacturing, Processing, and Fabrication Plants Using Toxic Materials		X	
36.	Residential Housing Units		X	
37.	Convalescent Home		X	
38.	Medical Clinic			X
39.	Medical/Dental Building			X
40.	Multipurpose Commercial Buildings		X	
41.	Office Building		X	
42.	Hospitals			X
43.	Home for the Aged		X	
44.	Mortuary			X
45.	Morgue			X
46.	Nursing Home		X	
47.	Elementary, High Schools, Trade Schools, and Colleges		X	
48.	Schools with Laboratories			X
49.	Hotel		X	
50.	Hotel with House Pump and/or Water Storage Tank			X
51.	Public Building (Federal/State/City)			

	a.	Potential Health Threat			X
	b.	Potential Pollution		X	
	c.	Restricted/Classified or Closed Facilities			X
52.	Restaurant (Any Food Handling Establishment)			X	
53.	Supermarket			X	
54.	*Building with House Pump and/or Water Storage Tank			X	
55.	*Building with Sewage Ejectors				X

ACCEPTED MANUFACTURERS	MODEL NUMBERS		
Watts	#7U2-2	#007	#009
Wilkins	#700	#950XL	#975XL
Conbraco	#4P-300	#40-100	#40-200
Febco	#810	#805Y	#825Y
OR ASSE APPROVED EQUIVALENT			

*Apply to any building regardless of building purpose
Note: Contact your plumber for options to relieve possible high water pressure due to thermal expansion.

Recommended Backflow Prevention Devices (continued)

Fire Protection Systems

A. No Protection (No Device Required)

1. Wet system, no pumper connection on buildings three stories or less.
2. Dry system, no pumper connection.

B. Double Check Valve Assembly

1. Any system (wet or dry) with a pumper connection.
2. Wet system only within line booster pump on building over three stories high.
3. Any system with private hydrants.

C. Reduced Pressure Zone Device

1. Any system where anti-freeze or inhibitors are used.
2. Any system where an auxiliary water source is available and connected to the fire system.

Appendix B
Backflow Prevention Devices

In selecting for use of the devices outlined in this section, it is vital that the degree of protection provided be commensurate with the degree of hazard present. It also is important that the limitations of each device be understood since the degree of protection provided will depend on the type of backflow prevention device and the maintenance program employed.

Acceptable backflow prevention devices used for cross-connection control are as follows:

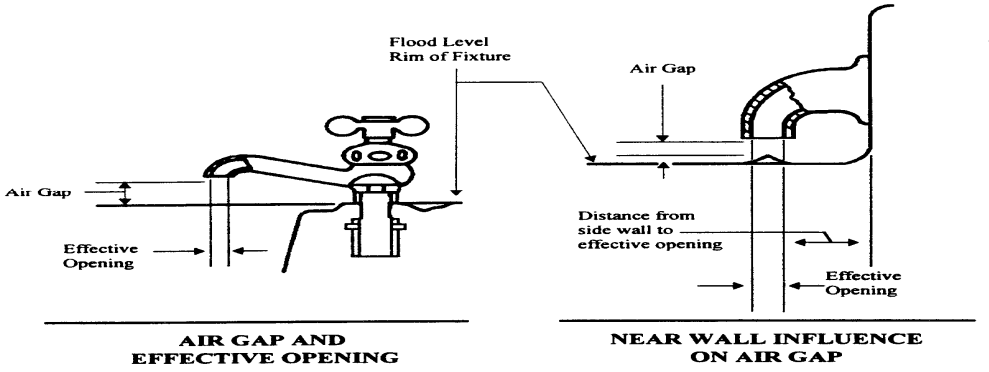
A. Air Gap
B. Double Check Valve Assembly (DCVA)*
C. Reduced Pressure Zone Devices (RPZD)*
D. Residential Dual Check Valve (RDCV)
E. Atmospheric Vacuum Breaker (AVB)
F. Hose-Bibb Vacuum Breaker (HBVB)
G. Pressure Vacuum Breaker (PVB)

*DCVAs and RPZDs should conform to ANSI/AWWA Standards C510 and C511, respectively.

Air Gap

An air gap separation provides a complete physical separation between the free flowing discharge end of a potable water supply line, faucet, plumbing fixture, or other device and the flood level rim of an open or nonpressure receiving vessel. An acceptable air-gap separation shall be at least double the diameter of the supply line. In no case shall the air gap be less than one inch.

Figure B.1 - Air Gap



Minimum Air Gaps for Plumbing Fixtures Fixture

Fixture	When Not Affected By Near Wall (*) (Inches)	When Affected By Near Wall (**) (Inches)
Laboratories and other fixtures with effective opening not greater than 1/2 inch diameter	1	1-1/2
Sink, laundry trays, goose-neck bath faucets and other fixtures with effective openings not greater than 3/4inch diameter	1-1/2	2-1/4
Over rim bath fillers and other fixtures with effective openings not greater than one inch diameter	2	3
Effective openings greater than one inches	2X Diameter of Effective Opening	3X Diameter of Effective Opening

* Side walls, ribs or similar obstructions do not effect air gaps when spaced from inside edge of spout opening a distance greater than three times the diameter of the effective opening for a single wall, or a distance greater than four times the diameter of the effective opening for two intersecting walls.

** Vertical walls, ribs, or similar obstructions extending from the water surface to or above the horizontal plane of the spout opening require a greater air gap when spaced closer to the nearest inside edge of spout opening than specified in (*)

above. The effect of three or more such vertical walls or ribs has not been determined. In such cases, the air gap shall be measured from the top of the wall.

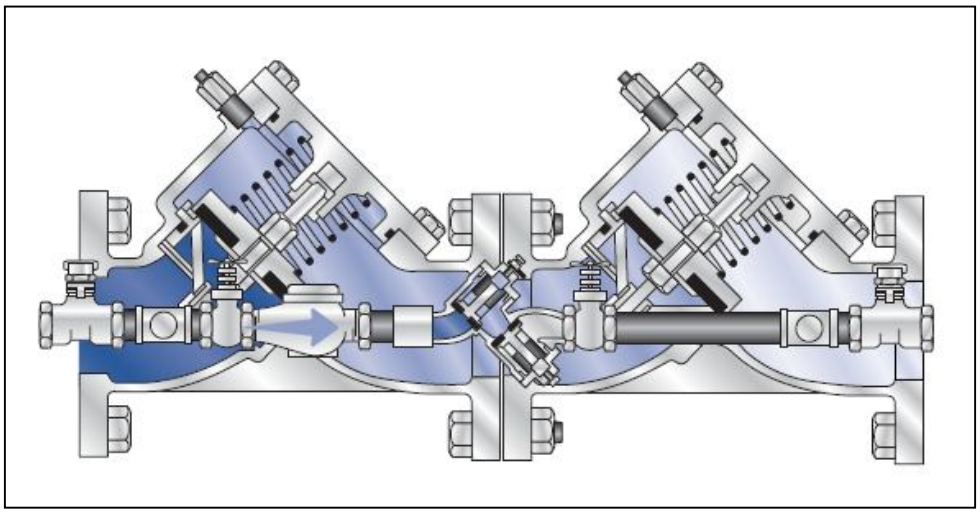
Double Check Valve Assembly (DCVA)

The DCVA consists of two independently acting, soft-seated, spring-loaded, check valves mounted in series with two tightly closing shutoff valves and four test cocks (see Figure B.2).

Double check valve assemblies prevent backflow caused by both backsiphonage and backpressure.

.

Figure B.2 Double Check Valve Assembly

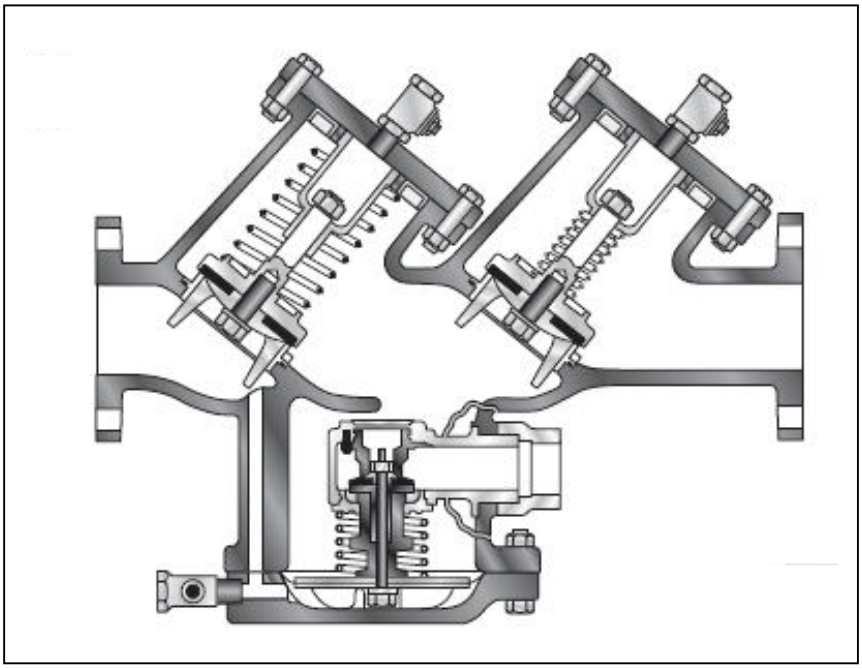


Note: Check valves are in the backflow position

Reduced Pressure Zone Device (RPZD)

This device consists of two soft-seated, spring-loaded check valves operating in series, and a soft-seated, spring-loaded, diaphragm-activated, pressure differential relief valve, located in the zone between the check valves (see Figure B.3). Two tightly closing shutoff valves and four test cocks complete the assembly. These devices will indicate leakage through one or both check valves or the relief valve by the discharge of water from the relief valve port. This factor is an important advantage over the double check valve assembly

Figure B.3 Reduced Pressure Zone Device



Note: Check valves are in the backflow position. The relief valve is in the normal flow position

Residential Dual Check Valve (RDCV) and the Vacuum Breakers

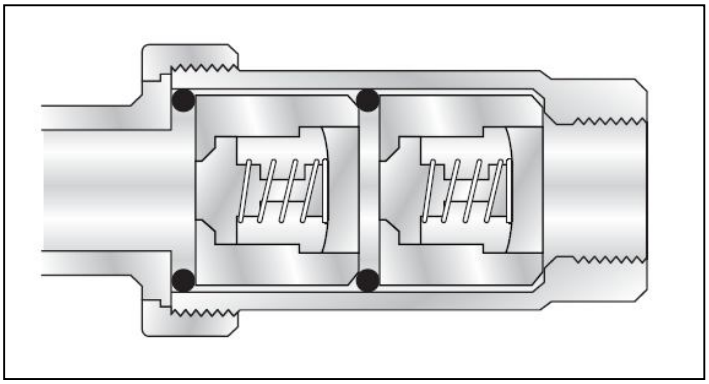
Only the air gap, DCVA and RPZD are testable devices that prevent backflow caused by both backsiphonage and backpressure.* The RDCV prevents backflow caused by both backsiphonage and backpressure, but is non-testable.

* The air gap can be considered "testable" in the sense that it can be visually inspected.

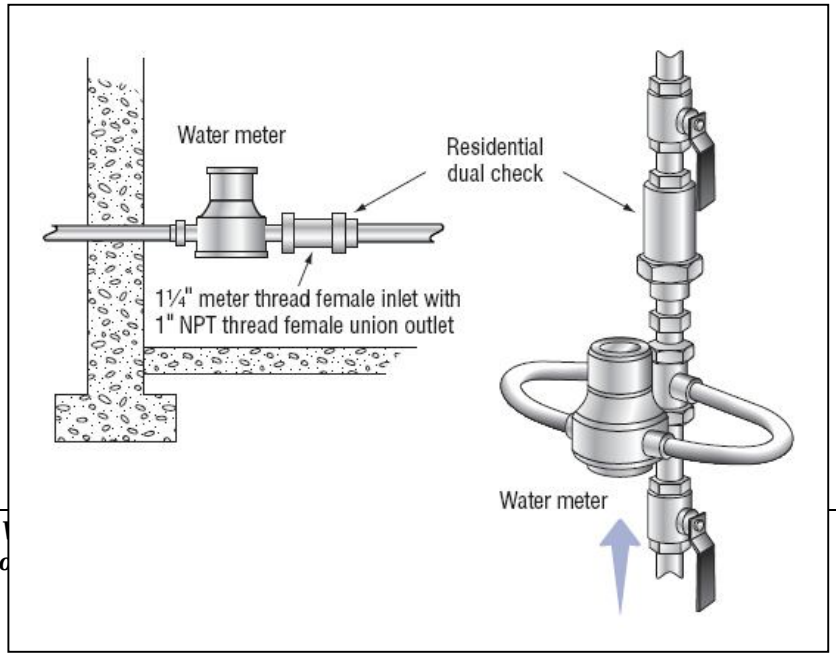
Residential Dual Check Valve:

The RDCV is a practical, non-testable device that can be installed for containment protection at residential homes. The RDCV is installed in-line and downstream of the service meter, and contains no shutoff valves. The RDCV prevents backflow caused by both backsiphonage and backpressure, but is recommended only for residential homes which are considered to be a nonhealth hazard (see Figure B.4).

Figure B.4 Residential Dual Check Valve



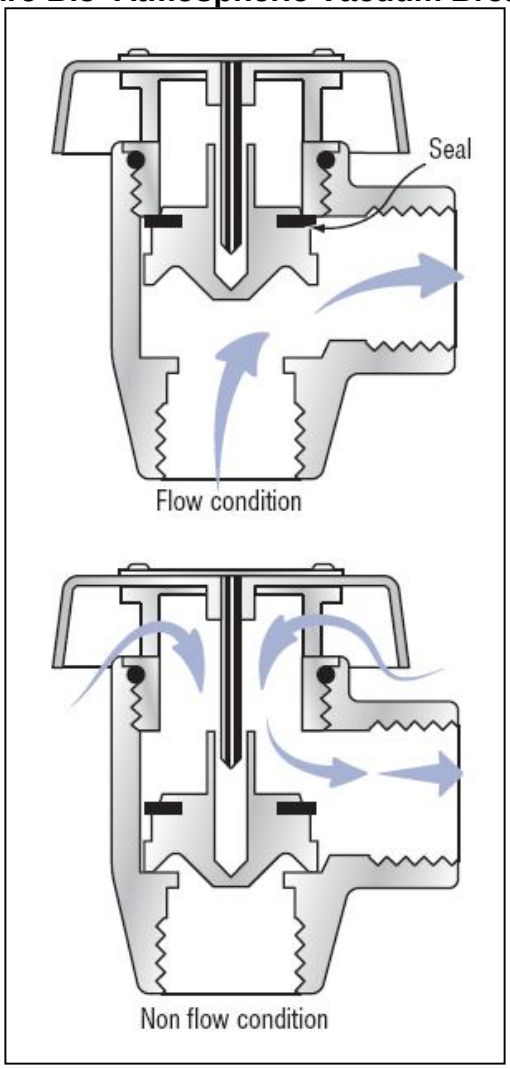
Sample Installations



Atmospheric Vacuum Breaker:

The AVB is a non-testable device that is installed at fixture outlets. The AVB prevents backflow caused by backsiphonage, but not backpressure. The AVB must not be kept under continuous pressure for more than 12 hours in any 24-hour period. Because of this requirement, no shut-off valve should ever be installed downstream of the AVB. A shutoff valve upstream of the AVB is recommended. The AVB should be installed at least six inches above the fixture outlet (see Figure B.5).

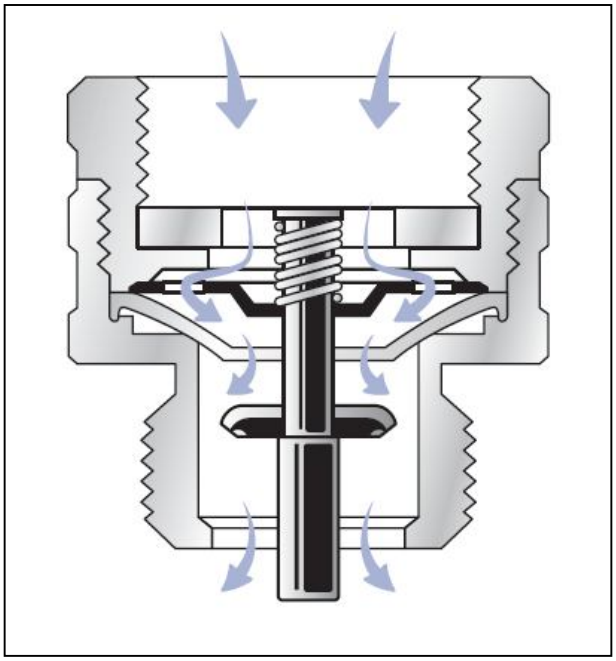
Figure B.5 Atmospheric Vacuum Breaker



Hose-Bibb Vacuum Breaker:

The HBVB is a non-testable device that is installed at fixture outlets. The HBVB prevents backflow caused by backsiphonage, but not backpressure (see Figure B.6).

Figure B.6 Hose-Bibb Vacuum Breaker



Pressure Vacuum Breaker:

The PVB is a testable device that is equipped with test cocks and shutoff valves, and is installed at fixture outlets. The PVB prevents backflow caused by backsiphonage, but not backpressure (see Figure B.7).

Figure B.7 Pressure Vacuum Breaker