Cross Connection Control Refresher for Community Water Supply Operators & New Technologies for Flow Control by Watts presented by Mid-Continent

Offered by IRWA & The Environmental Resources Training Center

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Overview of Topics

Legal and Regulatory Responsibilities

Community Water Supplies Role

Managing your Cross Connection Control Program

Test Paperwork

Containment vs Isolation`

Fire Supression and NFPA 25

Case Study

- Legal precedent for cross connection control responsibility was laid in 1929 by the Indiana Appellate Court, in the Pennsylvania Railroad Company vs Lincoln Trust Company.
- Contaminated water entered the Fort Wayne public water supply through a cross connection with a water main owned by the Pennsylvania Railroad resulting in the death of a municipal customer.
- Judgement: “The city having permitted the railroad company to connect its water main with the water main of the City, was ***duty-bound*** to exercise reasonable care to see that no polluted and impure water was allowed to enter its mains through the water main of the railroad.”

Federal Regulations Enacted in 1970's & Updated in 1990's

Safe Drinking Water Act

Established in 1974

In its simplest form, it contained provisions to help protect our potable water supply, which includes our aquifers and distribution systems. In addition, it has direct procedures for addressing any contamination that could potentially occur or that has already occurred.

The 1996 Safe Drinking Water Act Amendments created a coordinated set of programs and requirements to help water systems make sure they have a safe supply of drinking water. These programs and requirements form a "***Multiple Barrier***" approach in helping to protect the potable water system and the Cross-Connection Control Program is one part of those barriers. The CCC Program is designed to protect the potable water system from potential contamination by establishing protection from industry, agriculture, commercial business, and residential homes.

The State of Illinois is a ***Primacy State,*** which means it accepts primary enforcement responsibility for the operation of the state's drinking water program.

The Illinois Environmental Protection Act states that ***owners and official custodians*** of public water supplies (CWS) shall direct and maintain the continuous operation and maintenance of water supply facilities so that water shall be assuredly safe in quality, clean, adequate in quantity and of satisfactory mineral character for ordinary consumption.

The Illinois Environmental Protection Agency (IEPA) must establish requirements for public water systems at least as stringent as those set by the USEPA.

Each Illinois CWS must enact ordinances that outline the EPA, IEPA, and IDPH code they must enforce. ***Ordinances*** are legal documents that outline the terms of service for water customers.

35 Illinois Administrative Code

- **601.105 Definitions**

"Cross-connection" means any physical connection or arrangement between two otherwise separate piping systems where flow from one system to the other is possible.

- **604.1505 Cross Connection Control Program**

- a) All community water supplies, including those that meet the criteria in Section 17 (b) of the Act and any exempt community water supply as defined in Section 9.1 of the Public Water Supply Operations Act [415 ILCS 45], must have a cross connection control program to educate and inform water supply consumers regarding prevention of the entry of contaminants into

Regulatory Basics in Illinois

No physical connection shall be permitted between the potable portion of a supply and any other water supply not of equal or better bacteriological and chemical quality.

Control of all cross-connections to a supply is the responsibility of the ***owner or official custodian*** of the supply.

The agency (IEPA) may adopt specific conditions for control of unsafe cross-connections, which shall be complied with by the supplies (CWS) of this State.

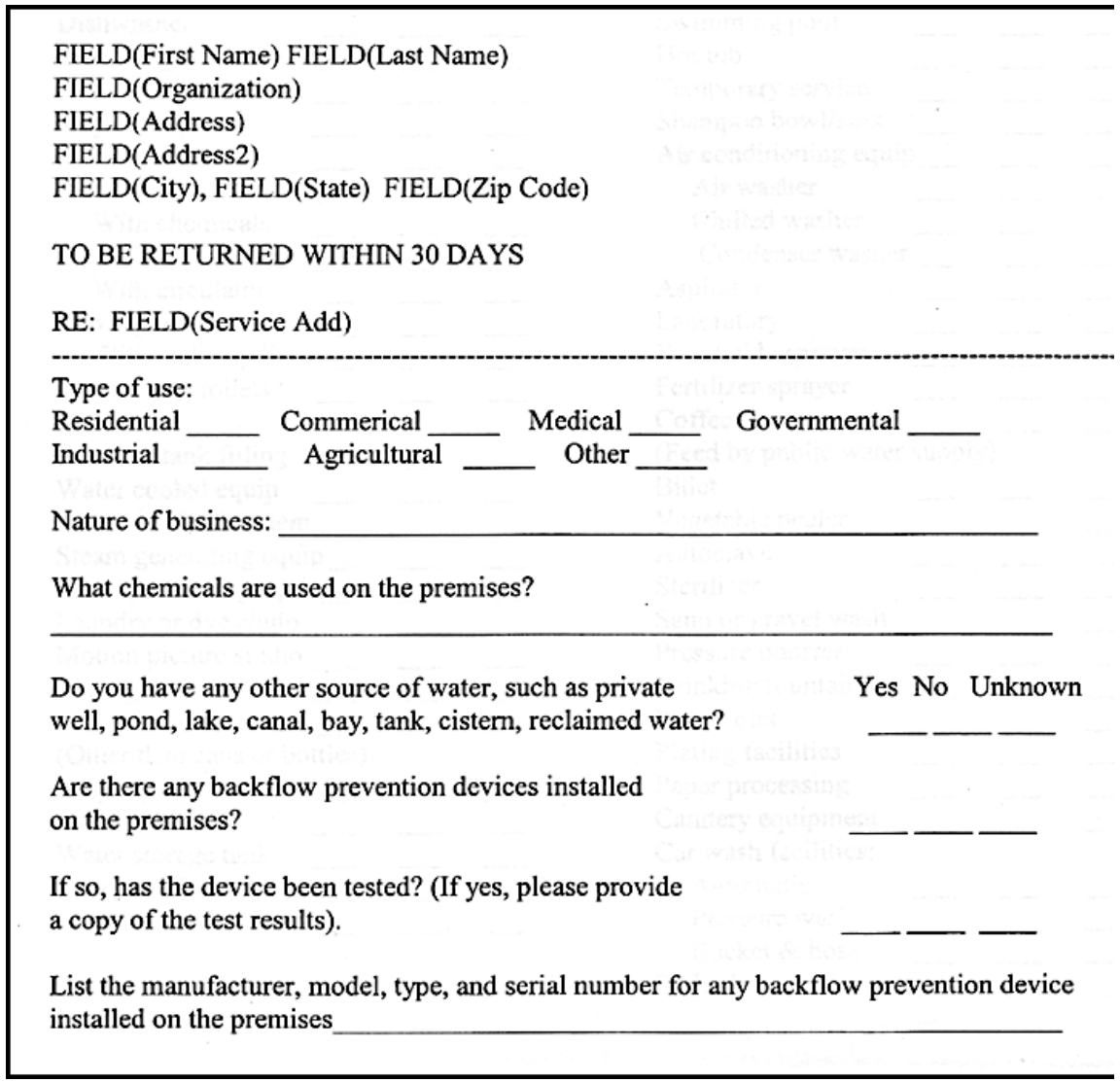
CWS is responsible for ***creating ordinances,*** which are legal documents outlining the terms by which customers can receive service.

Enforcement of Cross-Connection Control regulations are the responsibility of the CWS, and must be as strict or stricter than those established by IEPA.

- **Section 604.1505 Cross Connection Control Program**
  - 1) For any new service connection, the community water supply must evaluate the risk of cross connection whereby an unsafe substance may enter a community water supply.
  - 2) A community water supply must conduct a cross connection control survey of the distribution system at least every three years. The survey must be conducted by the owner, official custodian or an authorized delegate. The survey must evaluate the risk of an unsafe substance entering a community water supply through each service connection to the distribution system of the community water supply. This survey is not intended

Cross Connection Control Program Specifics

- Survey of all customers required ***every three years.***
- **All customers with service connection:** agricultural, industrial, commercial, and residential.
- CWS must incorporate ordinance which includes a plumbing code at least as stringent as the Illinois Plumbing Code, 77 Ill. Adm. Code 890.
- Assists official custodian in identifying High Hazard cross connections.



FIELD(First Name) FIELD(Last Name)
FIELD(Organization)
FIELD(Address)
FIELD(Address2)
FIELD(City), FIELD(State) FIELD(Zip Code)

TO BE RETURNED WITHIN 30 DAYS

RE: FIELD(Service Add)

Type of use:
Residential _____ Commerical _____ Medical _____ Governmental _____
Industrial _____ Agricultural _____ Other _____

Nature of business: _____

What chemicals are used on the premises?
_____

	Yes	No	Unknown
Do you have any other source of water, such as private well, pond, lake, canal, bay, tank, cistern, reclaimed water?	___	___	___
Are there any backflow prevention devices installed on the premises?	___	___	___
If so, has the device been tested? (If yes, please provide a copy of the test results).	___	___	___

List the manufacturer, model, type, and serial number for any backflow prevention device installed on the premises_____

Containment and Isolation of Potential Dangers

Facilities For Which Service Line Backflow Protection Should Be Considered:

a. Industries
b. Water and Wastewater Treatment Plants
c. Car Washes
d. Human and Animal Hospitals
e. Restaurants
f. Mortuaries
g. Universities
h. Schools
i. Shopping Centers
j. Fertilizer Plants
k. Fire Hydrants – temporary service connection via hydrant

Physical Units For Which Individual Backflow Protection Should Be Considered:

a. Boilers
b. Pumps
c. Cooling Towers
d. Lawn Irrigation Systems
e. Fire Protection Systems
f. Autopsy Rooms
g. Sewer Flushing
h. Swimming Pools
i. Auxiliary Water Systems
j. Dental Chairs

Where is the device located (Be specific) _____

Do you have any of the equipment listed below on the pemises?

	Yes	No	Unk.
Fire sprinkler system			
With chemicals			
Alternate water source			
Dishwasher			
Lawn irrigation			
Petroleum processing			
Vegetable peeler			
Bedpan washer			
Boiler			
With chemicals			
With feed line			
With circulator			
Cooling tower			
With make up line			
Power flush toilets (No tank)			
Truck or tank filling			
Water cooled equip			
Industrial fluid system			
Steam generating equip			
Photo processing equip			
Laundry or dye equip			
Motion picture studio			
Garbage can washer			
Soft drink dispenser (Other than cans or bottles)			
Soap injector			
Steam table			
Water storage tank			
Chemical feeder			
Chlorinator			

	Yes	No	Unk.
Baptismal Fount/Tub			
Floor drain			
Commercial ice maker			
Swimming pool			
Hot tub			
Temporary service			
Shampoo bowl/sink			
Air conditioning equip			
Air washer			
Chilled washer			
Condenser washer			
Aspirator			
Laboratory			
Weedicide sprayer			
Fertilizer sprayer			
Coffee urn (Feed by public water supply)			
Bidet			
Vegetable peeler			
Autoclave			
Sterilizer			
Sand or gravel wash			
Pressure booster			
Drinking fountains			
Reservoirs			
Plating facilities			
Paper processing			
Cannery equipment			
Car wash facilities:			
Automatic			
Pressure wash			
Bucket & hose			
Bathtub			

CCCDI Testing Paperwork

- Important piece of a water departments cross-connection control program
- Copy of the test results submitted to official custodian of CWS, property owner, pluming inspector (if applicable), and CCCDI for records
- CCCDIs also must complete a maintenance log maintained on the site of installation and located on or near the unit in question

- **Section 604.1510 Cross Connection Control Device Inspectors**

  - a) Except as provided in subsection (c), cross connection control devices must be inspected at least annually by a person approved by the Agency or its designee as a cross connection control device inspector (CCCDI). The inspection of mechanical devices must include physical testing in accordance with the manufacturer's instructions.

  Records of the annual inspection must be submitted to the community water supply.

  Each device inspected must have a tag attached listing the date of the most recent test, name of CCCDI, and type and date of repairs.

- **Section 604.1510 Cross Connection Control Device Inspectors** (continued)

A maintenance log must be maintained at the site of installation and must include:

A) make, model and serial number of the backflow preventer, and its location at the site;

B) date of each test;

C) name and approval number of person performing the test;

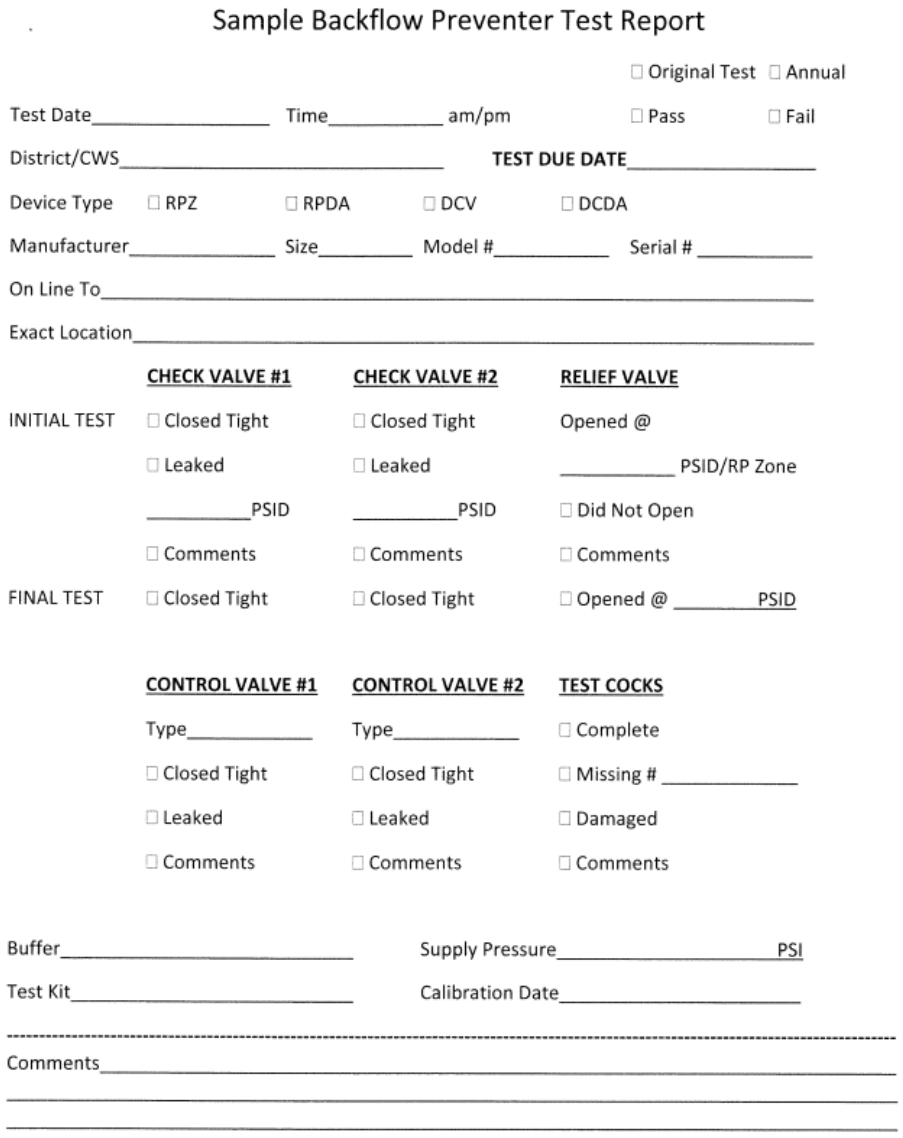
D) type of test kit used and date of its most recent calibration;

E) test results and a brief statement indicating whether the results pass or fail the test;

F) repairs or servicing required;

G) repairs and date completed; and

H) servicing performed and date completed.



Sample Backflow Preventer Test Report

☐ Original Test ☐ Annual

Test Date_____ Time_____ am/pm ☐ Pass ☐ Fail

District/CWS_____ **TEST DUE DATE**_____

Device Type ☐ RPZ ☐ RPDA ☐ DCV ☐ DCDA

Manufacturer_____ Size_____ Model #_____ Serial # _____

On Line To_____

Exact Location_____

	CHECK VALVE #1	**CHECK VALVE #2**	**RELIEF VALVE**
INITIAL TEST	☐ Closed Tight	☐ Closed Tight	Opened @
	☐ Leaked	☐ Leaked	_____ PSID/RP Zone
	_____PSID	_____PSID	☐ Did Not Open
	☐ Comments	☐ Comments	☐ Comments
FINAL TEST	☐ Closed Tight	☐ Closed Tight	☐ Opened @ _____PSID

	CONTROL VALVE #1	**CONTROL VALVE #2**	**TEST COCKS**
	Type_____	Type_____	☐ Complete
	☐ Closed Tight	☐ Closed Tight	☐ Missing # _____
	☐ Leaked	☐ Leaked	☐ Damaged
	☐ Comments	☐ Comments	☐ Comments

Buffer_____ Supply Pressure_____PSI

Test Kit_____ Calibration Date_____

Comments_____

_____

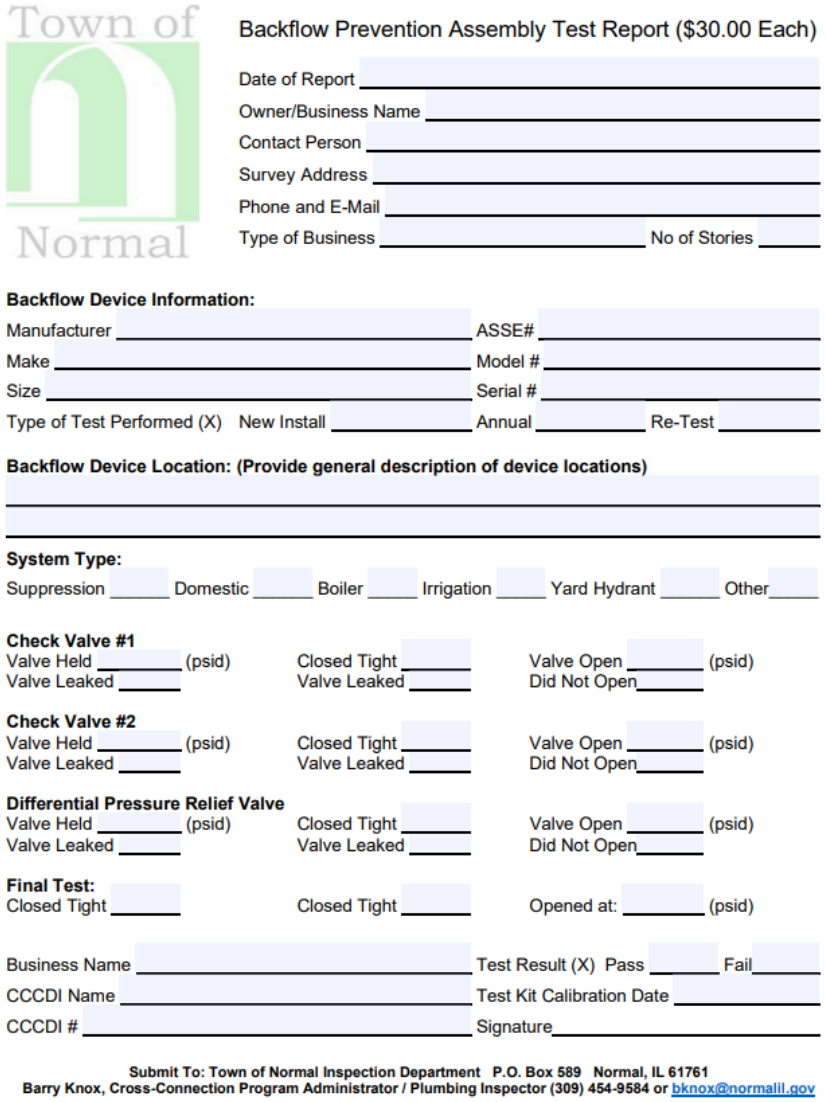
_____

Test Form FAQs

- Most large to medium sized CWS will have a standard form for testers to complete. Smaller districts might not have a form and can ask CCCDI performing the test to provide the necessary paperwork.
- Some CWS utilize cloud based computer programs (Chicago uses Compliance Engine) or 3rd parties that manage all or some of the Cross Connection program (BSI and Schaumberg)
- Original form must be submitted to "official custodian" of CWS
- IEPA requires all CWS to maintain 10 years of paperwork for customers with testable backflow assemblies
- Testers will provide a copy to property owner, retain a copy for their records, and provide a maintenance log at the site of the assembly.
- 3rd party companies, such as BSI or Aqua Backflow, can be contracted to manage paperwork. They typically utilize online

On the form to the right, note of the following:

- States that form fee is $30
- Type of business and number of stories on building
- Re-test is listed as option
- System type is requested
- How do we interpret "Final Test" towards bottom?
- No buffer line? Not requirement and can be calculated with data provided
- Lists where to submit paperwork, this is the ***"official custodian"*** for Normal, IL



Town of Normal

Backflow Prevention Assembly Test Report ($30.00 Each)

Date of Report _____

Owner/Business Name _____

Contact Person _____

Survey Address _____

Phone and E-Mail _____

Type of Business _____ No of Stories _____

Backflow Device Information:

Manufacturer _____ ASSE# _____

Make _____ Model # _____

Size _____ Serial # _____

Type of Test Performed (X) New Install _____ Annual _____ Re-Test _____

Backflow Device Location: (Provide general description of device locations)

_____

_____

System Type:

Suppression _____ Domestic _____ Boiler _____ Irrigation _____ Yard Hydrant _____ Other_____

Check Valve #1

Valve Held _____ (psid) Closed Tight _____ Valve Open _____ (psid)

Valve Leaked _____ Valve Leaked _____ Did Not Open_____

Check Valve #2

Valve Held _____ (psid) Closed Tight _____ Valve Open _____ (psid)

Valve Leaked _____ Valve Leaked _____ Did Not Open_____

Differential Pressure Relief Valve

Valve Held _____ (psid) Closed Tight _____ Valve Open _____ (psid)

Valve Leaked _____ Valve Leaked _____ Did Not Open_____

Final Test:

Closed Tight _____ Closed Tight _____ Opened at: _____ (psid)

Business Name _____ Test Result (X) Pass _____ Fail_____

CCCDI Name _____ Test Kit Calibration Date _____

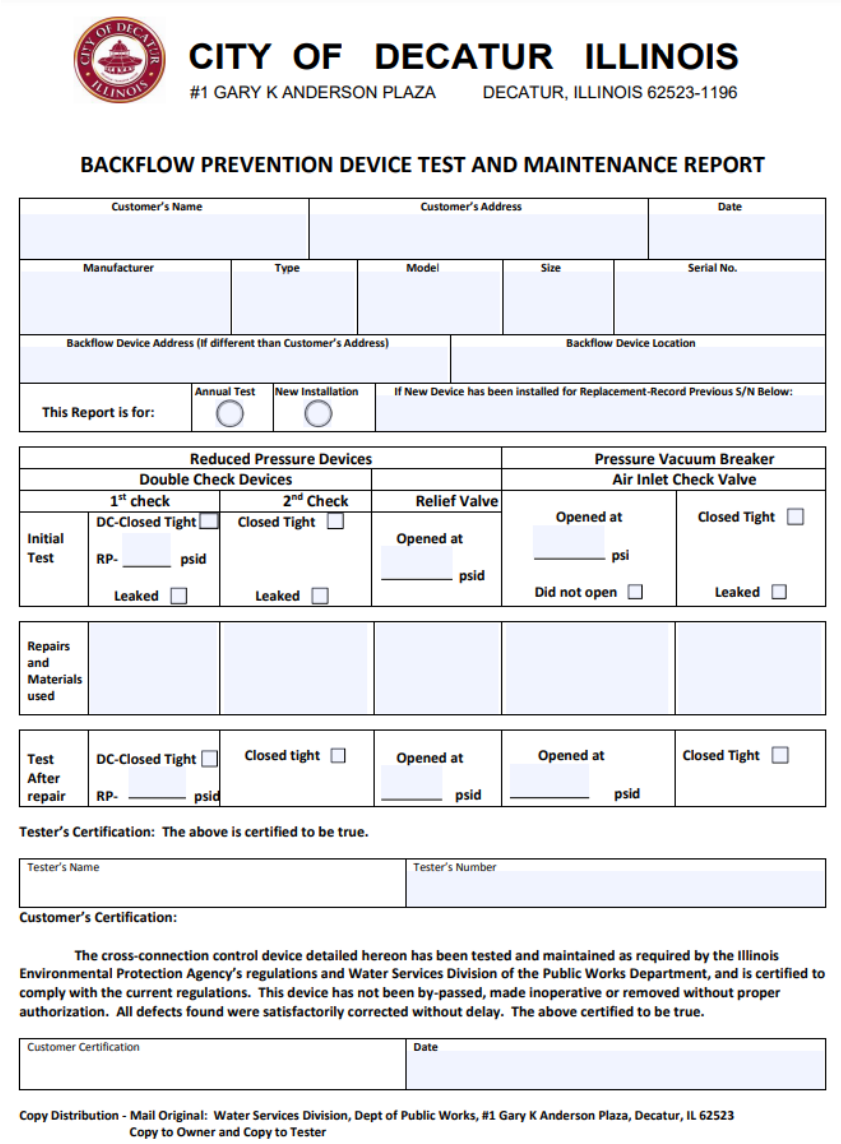
CCCDI # _____ Signature_____

Submit To: Town of Normal Inspection Department P.O. Box 589 Normal, IL 61761

Barry Knox, Cross-Connection Program Administrator / Plumbing Inspector (309) 454-9584 or bknox@normalil.gov

On the form to the right, note of the following:

- Outlines how to denote replacement. They want serial number of the device that has been removed.
- For DCV and RPZ 2nd Check, they only want to see that it "closed tight". They are assuming that a CCCDI will know that a DCV has to hold above 1 PSID for each check valve to pass.
- No buffer line? Not requirement and can be calculated with data provided
- Note details on installation, ***"assembly has not been bypassed, made inoperable or removed without authorization"***
- Lists where to submit ***original*** report. The ***Decatur, IL Water***



CITY OF DECATUR ILLINOIS

#1 GARY K ANDERSON PLAZA DECATUR, ILLINOIS 62523-1196

BACKFLOW PREVENTION DEVICE TEST AND MAINTENANCE REPORT

Customer's Name	Customer's Address	Date

Manufacturer	Type	Model	Size	Serial No.

Backflow Device Address (If different than Customer's Address)	Backflow Device Location

This Report is for:	Annual Test ◯	New Installation ◯	If New Device has been installed for Replacement-Record Previous S/N Below:

	Reduced Pressure Devices			Pressure Vacuum Breaker	
	Double Check Devices			Air Inlet Check Valve	
	1st check	2nd Check	Relief Valve		
Initial Test	DC-Closed Tight ☐ RP- ____ psid Leaked ☐	Closed Tight ☐ Leaked ☐	Opened at ____ psid	Opened at ____ psi Did not open ☐	Closed Tight ☐ Leaked ☐
Repairs and Materials used					
Test After repair	DC-Closed Tight ☐ RP- ____ psid	Closed tight ☐	Opened at ____ psid	Opened at ____ psid	Closed Tight ☐

Tester's Certification: The above is certified to be true.

Tester's Name	Tester's Number

Customer's Certification:

The cross-connection control device detailed hereon has been tested and maintained as required by the Illinois Environmental Protection Agency's regulations and Water Services Division of the Public Works Department, and is certified to comply with the current regulations. This device has not been by-passed, made inoperative or removed without proper authorization. All defects found were satisfactorily corrected without delay. The above certified to be true.

Customer Certification	Date

Copy Distribution - Mail Original: Water Services Division, Dept of Public Works, #1 Gary K Anderson Plaza, Decatur, IL 62523
Copy to Owner and Copy to Tester

01

How are we doing in Illinois?

02

Does your CWS have systems and procedures in place to meet regulatory compliance?

03

If not, there are 3rd party providers that specialize in managing all or some of these responsibilities.

- **There are a variety of options from simple data management to total program administration:**

- Cloud Based Data Management

- SwiftComply Backflow
- Syncta by Watts

- Illinois based companies offering total program administration

- Aqua Backflow
- Backflow Solutions Inc.
- Compliance Engine

Containment vs. Isolation

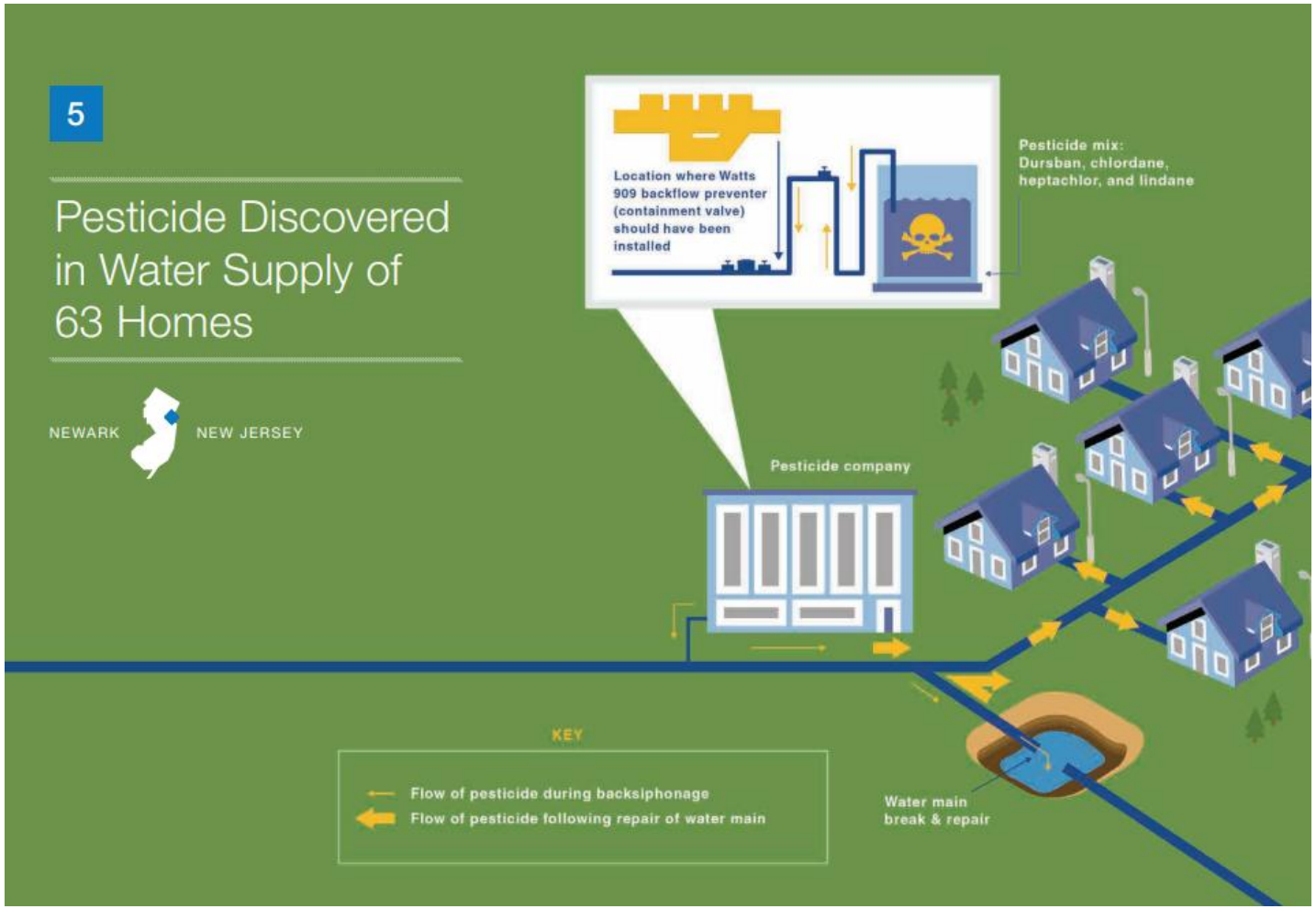
Containment

- Protects the distribution system from backflow by a ***premises.***
- Device or Assembly installed on the service line of the business or residence.
- Water is a perishable commodity. Once it passes onto the customer side of meter, the CWS does not want degraded or contaminated water coming back into the distribution system.

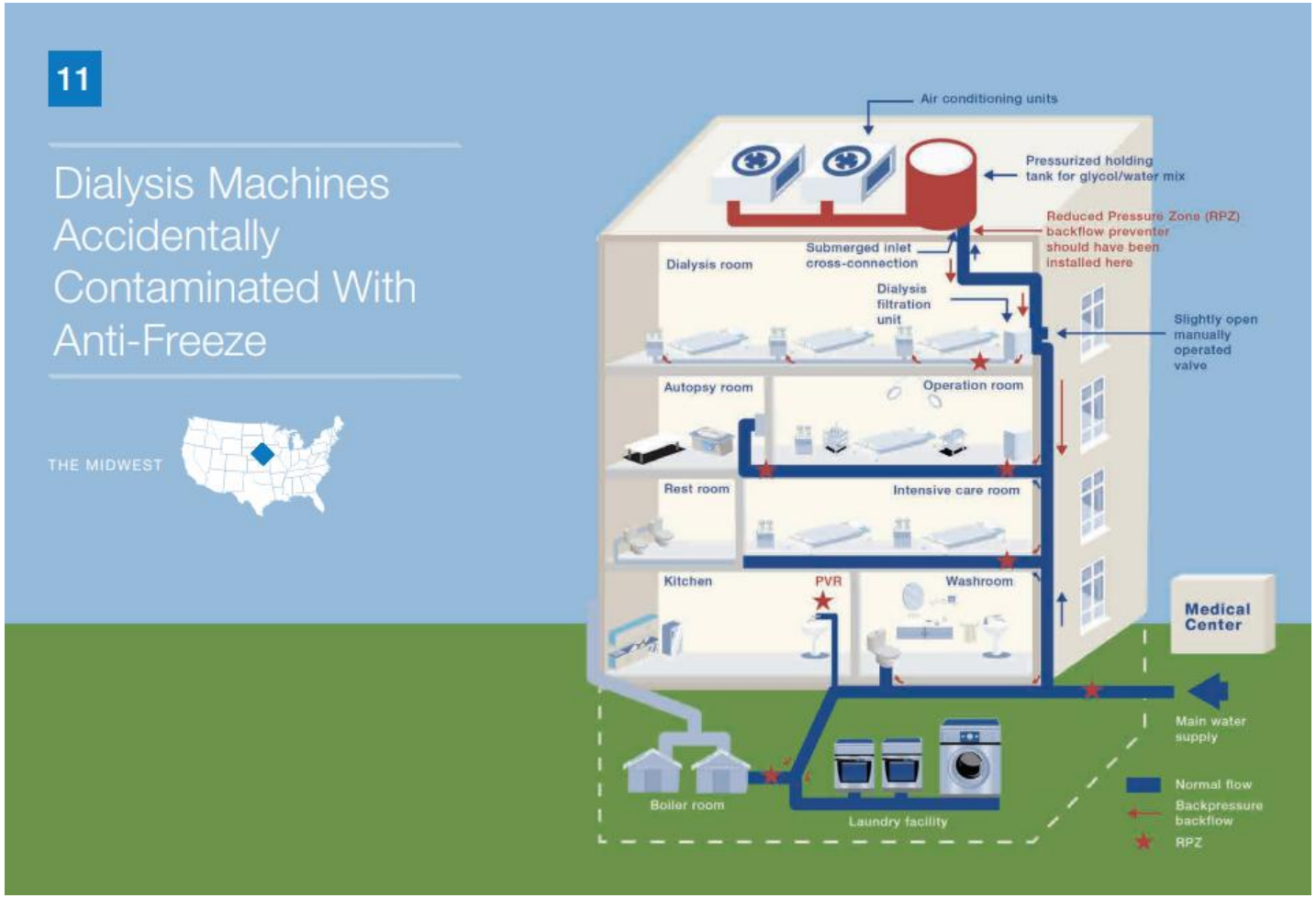
Isolation

- Installation of a backflow prevention device or assembly at each actual or potential cross connection ***within*** a premises to protect water quality within the building.
- Protects potable water for consumers within a premises.
- Examples: RPZ on a boiler with chemicals or fire suppression system with antifreeze.
- ***"I&I" isolate*** the

Containment Example



Isolation Example



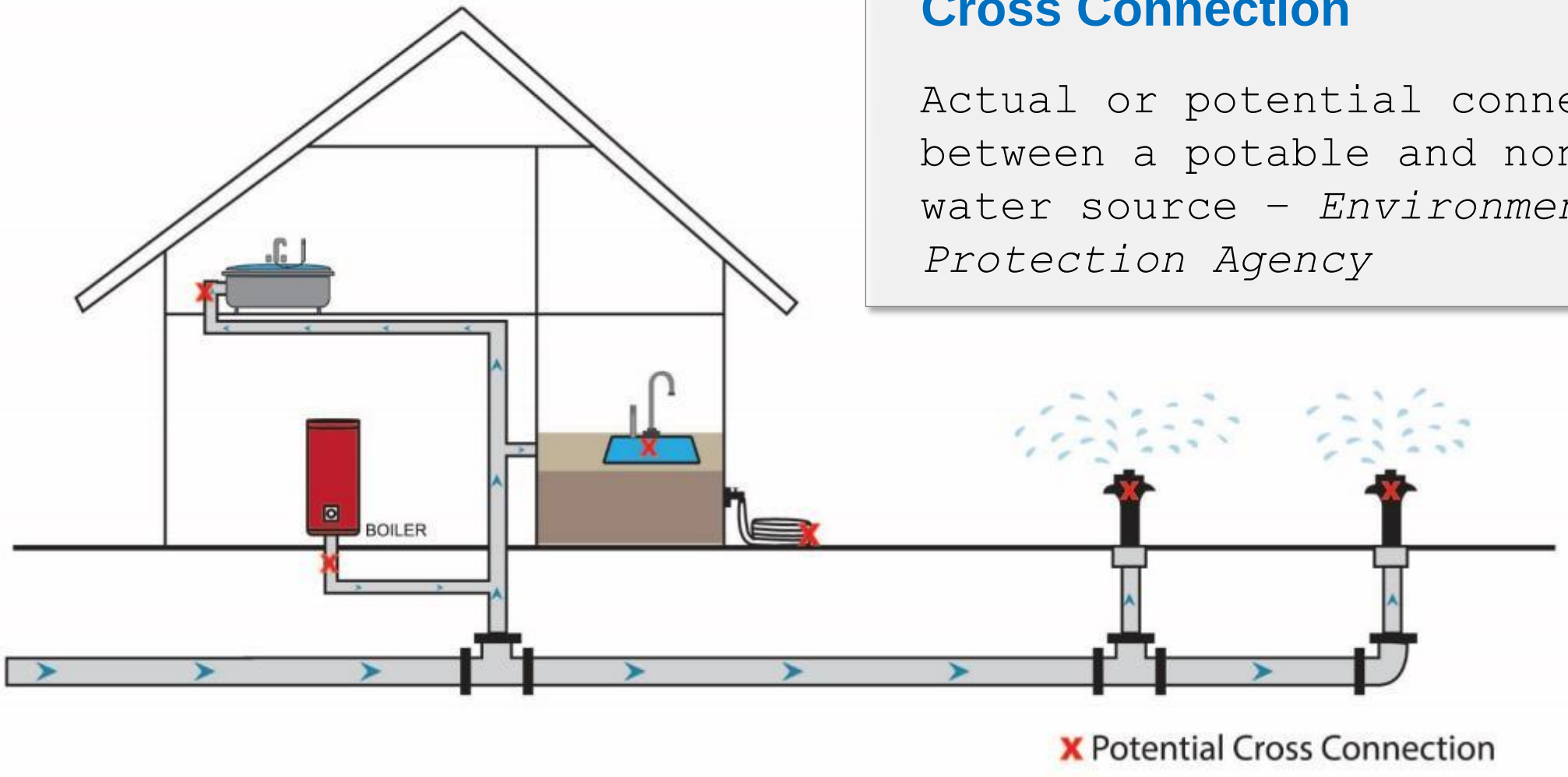
Our Audience: Watts Water Operators

Course Learning Objectives

At the completion of this course you will be able to:

- Describe Cross-Connection Control Programs and their importance to Total Backflow Protection
- Become familiar with cross-connection control terms and definitions
- Understand the importance of a backflow preventer to the protection and conservation of safe drinking water
- Become familiar with backflow prevention terms and definitions

What is a Cross-Connection?



Cross Connection

Actual or potential connections between a potable and non-potable water source – *Environmental Protection Agency*

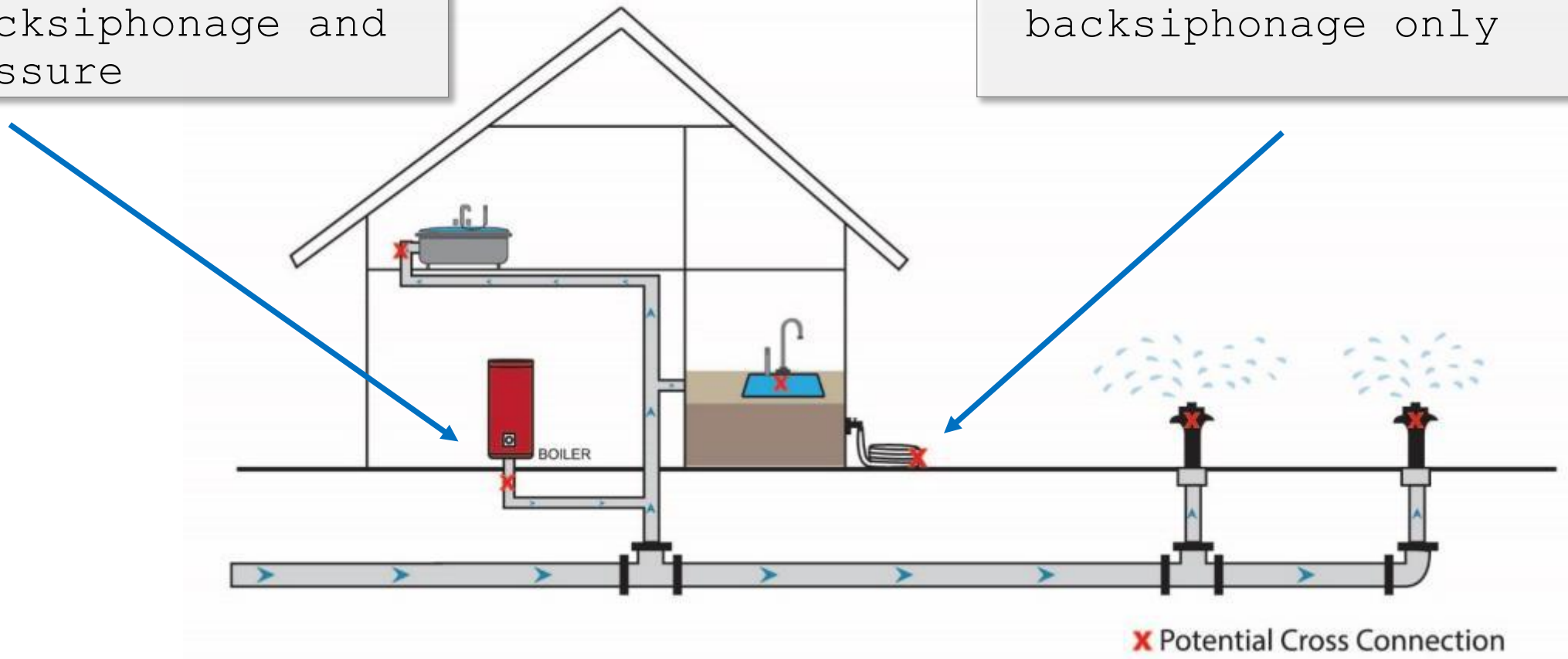
Types of Cross-Connections?

Direct Cross-Connection

- is a cross-connection which is subject to both backsiphonage and backpressure

Indirect Cross-Connection

- is a cross-connection which is subject to backsiphonage only



Protection and Conservation of Safe Drinking Water

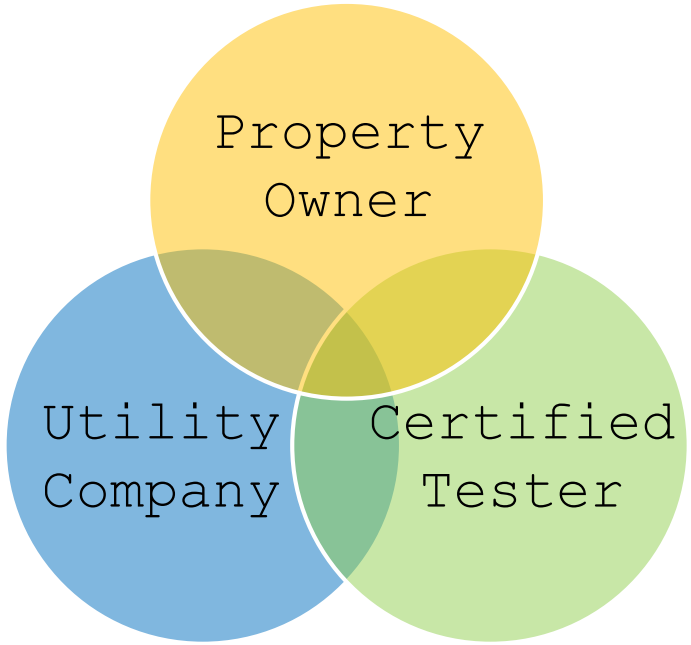
"All municipalities with public water supply systems should have cross-connection control programs." - *E.P.A.*

When you Combine…

Isolation Protection	Protects domestic water supply at point of use. Typically governed by plumbing codes and local or national ordinances.	
Containment	Protects water supplier's public water supply at the meter. Typically governed by the water purveyor.	
Total Backflow Protection	Assures safe drinking water from the point of treatment to the point of use by combining both of the above.	

Cross-Connection Control Program

The ABC's of Cross-Connection Control Program*



A Authority – legal basis to implement policy and enforce the program

B Backflow Preventers – approved backflow prevention assemblies

C Certified Testers and Specialists – for periodic field validation and program administration

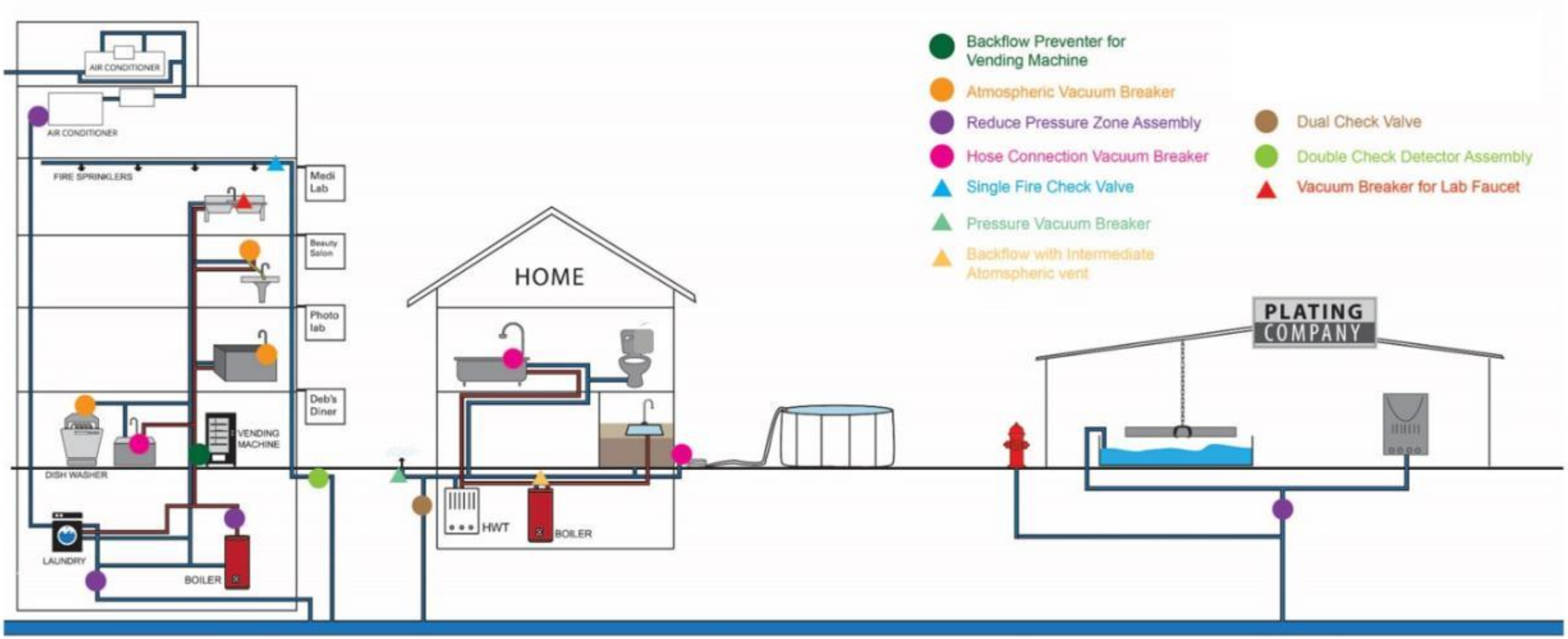
D Defensible and Detailed Records – document all program elements (policies and procedures, code requirements, site surveys, test records, etc.)

E Education and Training – staff and general public education; training for specialists and testers

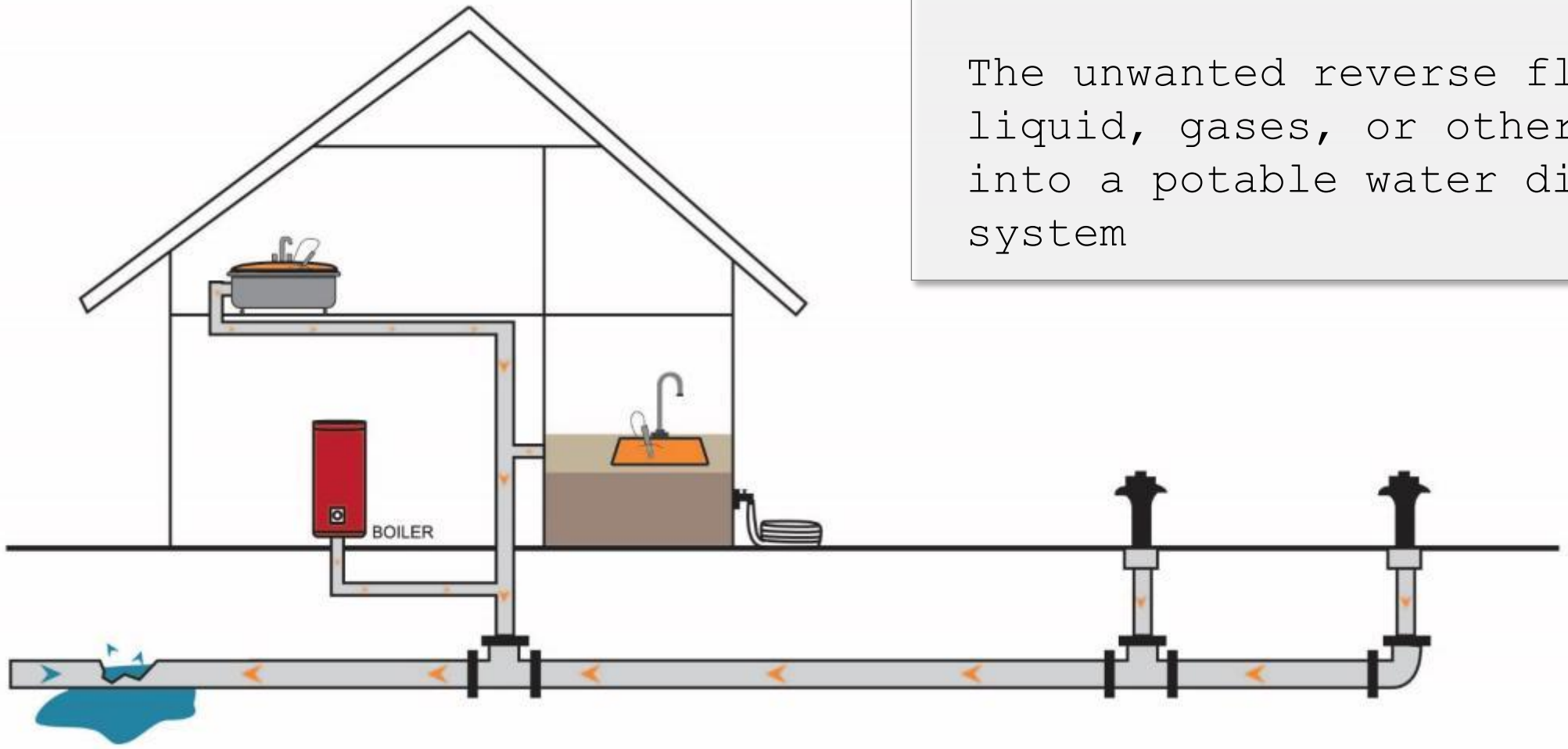
**Courtesy of USC-FCCCHR*

Solution = Appropriate Backflow Prevention Products

Where are the needs located?



What is Backflow?



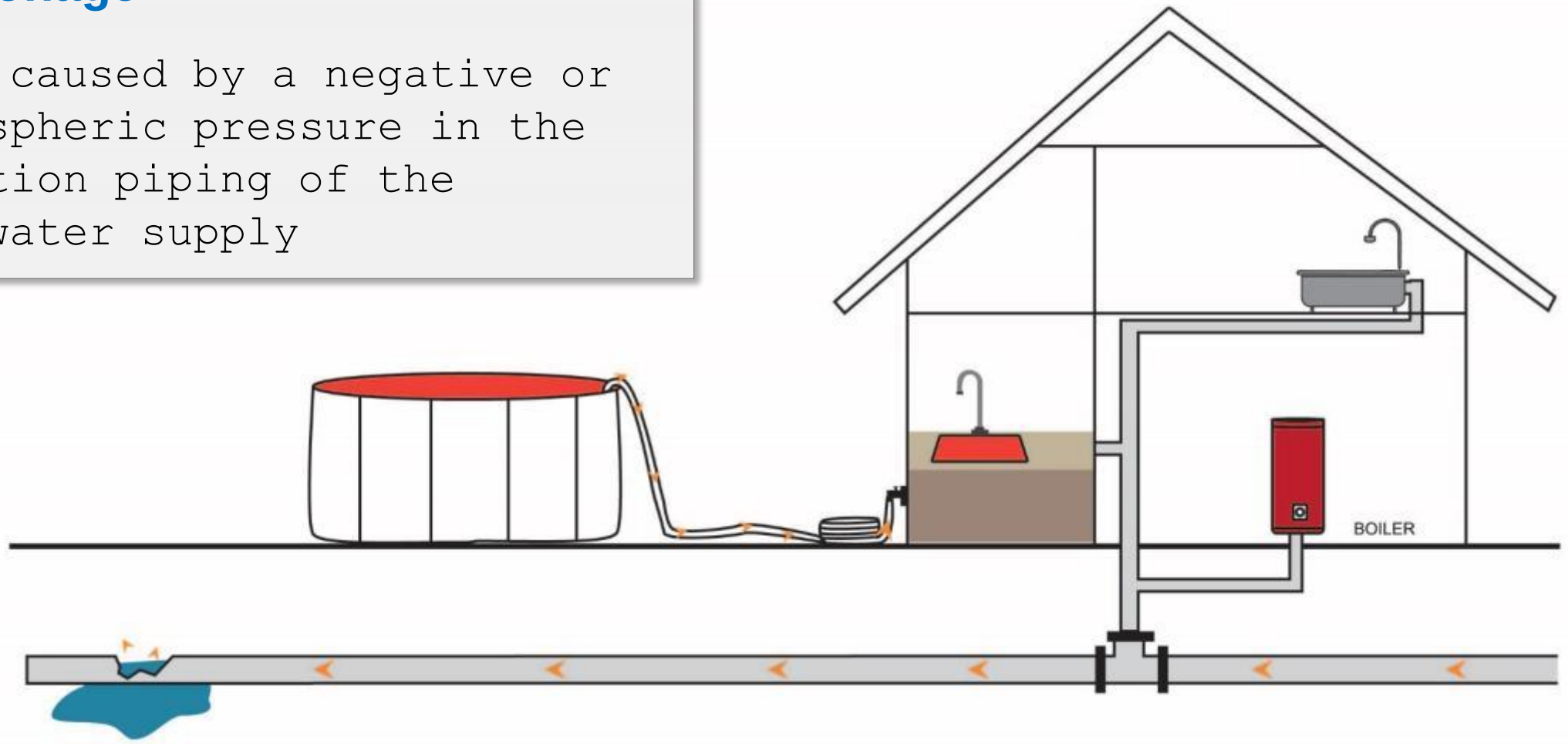
Backflow

The unwanted reverse flow of liquid, gases, or other substance into a potable water distribution system

What is Backsiphonage?

Backsiphonage

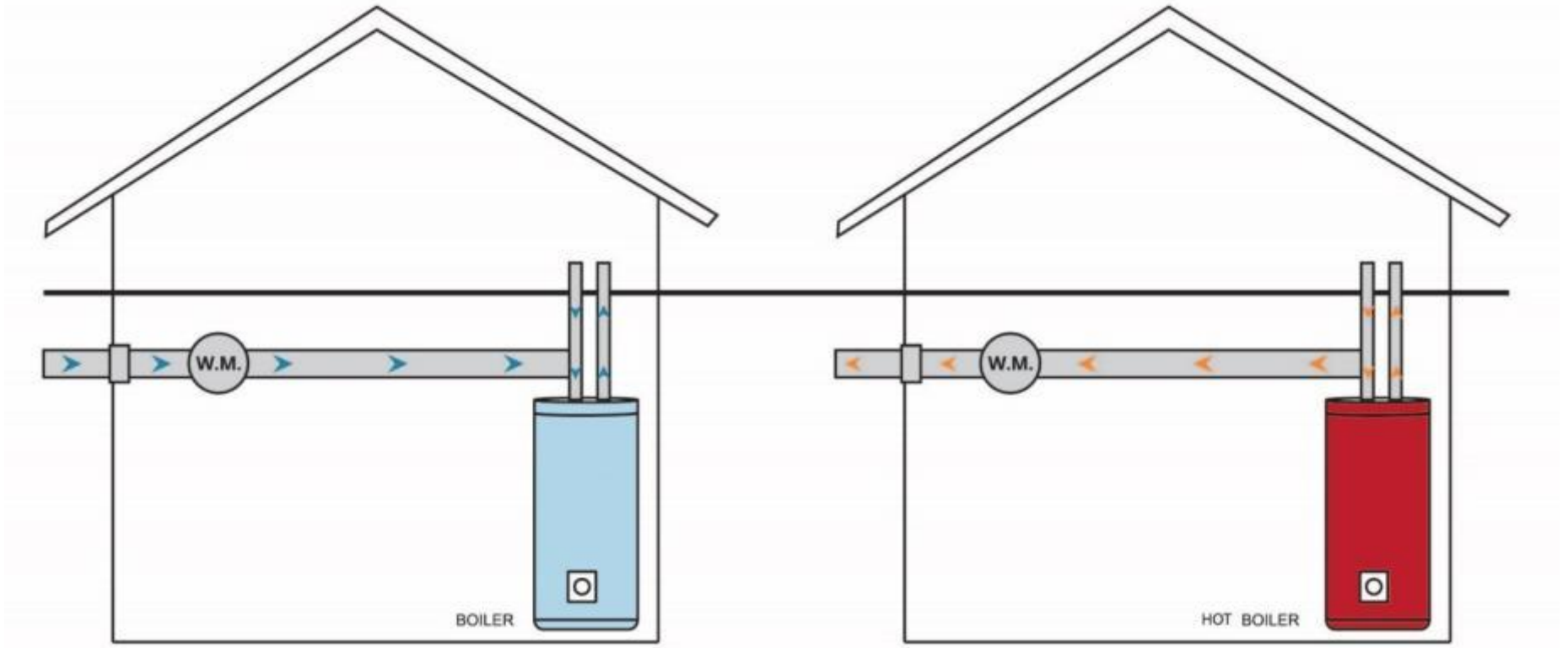
Backflow caused by a negative or sub-atmospheric pressure in the distribution piping of the potable water supply



What is Backpressure?

Backpressure

Backflow caused by an increase of pressure in the downstream piping system, creating a reversal in the normal direction of flow



*Example of thermal expansio

Protection Based on Degree of Hazard

What is the Difference?

Health Hazard

Contamination **-** any substance that shall impair the quality of water, in such a way as to create an actual hazard to the public health through poisoning, the spread of disease, etc.

Non-Health Hazard

Pollution **-** 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.

What Should I Use?

Ask the Four Questions:

1. What is the potential for **Backpressure**? Note: Backsiphonage is always possible.
2. What type of **Health Hazard** is exposed? Is your application Health Hazard vs. Non-Health Hazard?
3. Will the application need **24/7/365 continuous pressure**?
4. What is the valve **orientation** needed for your project?

Always check with the water authority having jurisdiction (AHJ)

Again:

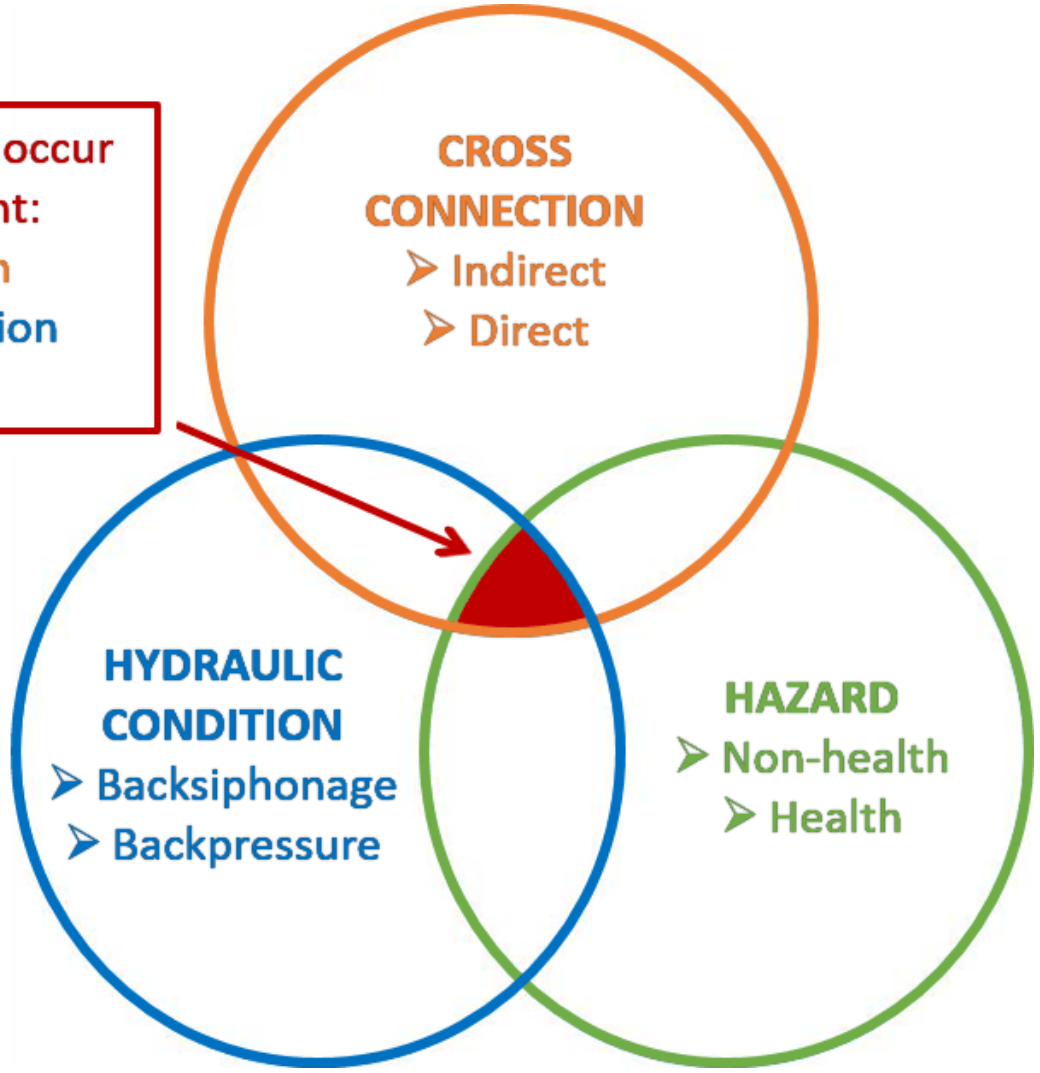
Ask the Question Again & Confirm:

Check with the water authority having jurisdiction (AHJ)

Backflow Incident Requirements

BACKFLOW can only occur if all three are present:

- Cross Connection
- Hydraulic Condition
- Hazard



Backflow Incidents

14 December 2016 Incident: Corpus Christi, Texas residents scrambled following the possible contamination of the city's water supply. The potential backflow of up to 24 gallons of the material, possibly in a mixture with hydrochloric acid, resulted in a temporary ban on use of tap water throughout the city's 320,000 residents. The ban remained in place in 85% of the city for nearly four days, leading to school closures and emergency deliveries of bottled water. City officials posted a warning to residents that "boiling, freezing, filtering, adding chlorine or other disinfectants, or letting the water stand will not make the water safe."

1 September 2012 Incident: Backflow Contamination in Boca Raton, Florida City Drinking Water. The Palm Beach County Health Department found a host of long-standing problems with the city's drinking water including fecal matter and other ingredients found in wastewater. The city did not have the proper check valves to keep reclaimed water from mixing with potable water. Anyone drinking the potable water may have been drinking more than potable water.

27 July 2015 Incident: Corpus Christi, Texas Sprinkler System Suspected of E-Coli Contamination. Corpus Christi utility crews pinpoint the source of the E-coli contamination; their investigation found an absent or failing backflow prevention device on a sprinkler system in the Flour Bluff area. The devices prevent water that enters private irrigation lines from re-entering the city's water lines and potentially leads to a contamination.

5 May 2010 Incident: A Boil-Water Order Issued in 30 Massachusetts Communities by Massachusetts Water Resources Authority (MWRA). A boil-water order was issued in 30 Massachusetts communities, including Boston, after a water pipe break. The order affected nearly two million in Massachusetts. A major pipe bringing water to the Boston area has sprung a "catastrophic" leak and is dumping eight million gallons of water per hour into the Charles River. Governor Deval Patrick declared a state of emergency and issued a boil-water order for Boston and dozens of other communities.

ESSENTIAL STATISTICS
2.55 million people served
890,000 households served
5,500 businesses served
215 million gallons per day of water supplied (average)
350 million gallons per day of sewage treated (average)
43 sewerage communities
51 water communities
61 communities collectively

Backflow Organizations and Associations

North American Performance Testing Standards and Educational Organizations	
ASSE	American Society of Sanitary Engineering
AWWA	American Water Works Association
ANSI/ASME	American National Standards Institute
CSA	Canadian Standards Association
USC-FCCCHR	University of Southern California Foundation for Cross-Connection Control and Hydraulic Research
UL/cUL	Underwriters Laboratories Inc.
FM	Factory Mutual
IAPMO	International Association of Plumbing & Mechanical Officials
NSF	National Sanitation Foundation
ABPA	American Backflow Prevention Association
UPC	Unified Plumbing Code

Valve Performance - Typical Flow Curve

Pressure (psi or bar)

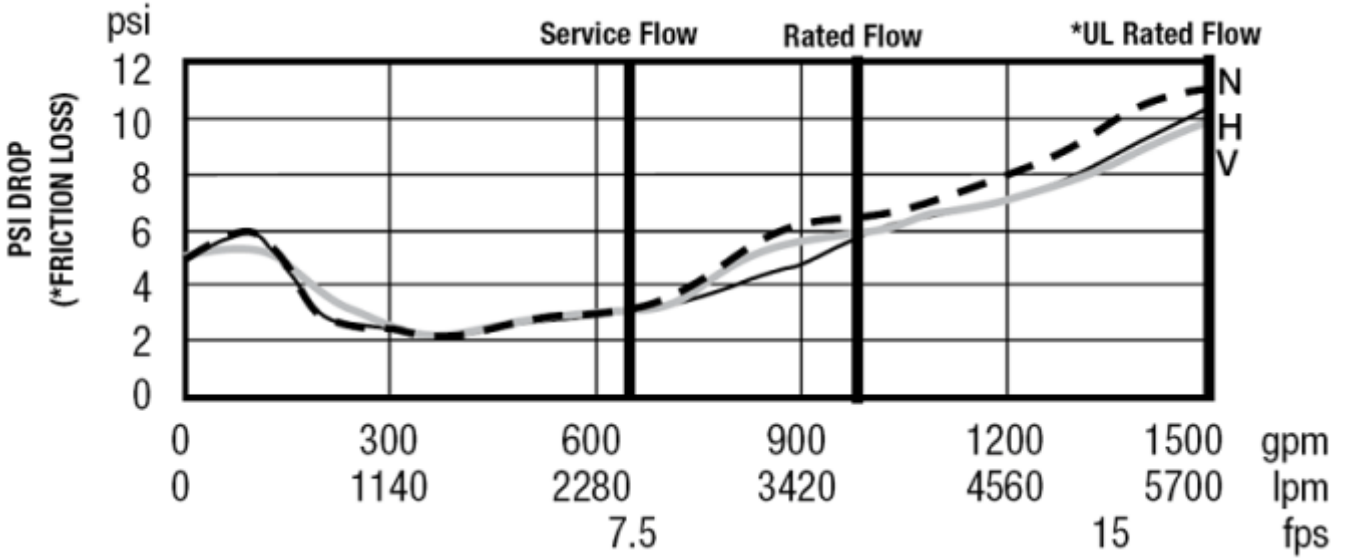
Force per unit area, for example pounds per square inch

Flow Rate and Velocity

- Flow rate is the amount of fluid that flows in a given time. Ex. Gallons per minute (gpm) and cubic feet per minute (CFM)
- Velocity is the rate of speed at which the fluid is moving. Ex. Feet per second (fps)

Flow Curve

Example of a Watts 6” 757 Double Check Valve Assembly



Two Categories of Backflow Prevention Valves

Non-Testable

- Atmospheric Vacuum Breaker (AVB)
- Hose Bibb Vacuum Breaker (HBVB)
- Dual Checks (DuC)
- Dual Checks with Atmospheric Vents (VDuC)
- Carbonated Beverage Bac Preventer (CBBP)
- Fireline Singl Check

Testable

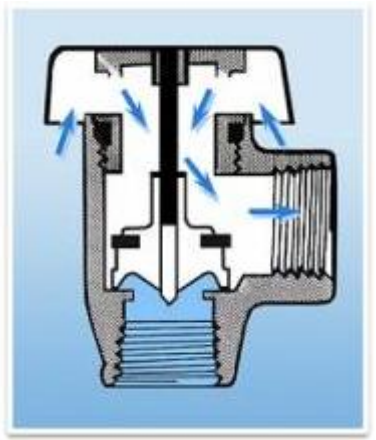
- Pressure Vacuum Breaker (PVB)
- Spill Resistant Vacuum Breaker (SVB)
- Double Check Valve Assembly (DC)
- Reduced Pressure Principal Backflow Preventer (RP)
- Detector Assembl ie (DCDA/RPDA)

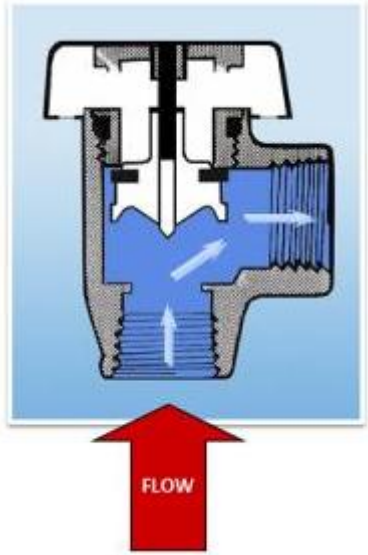
Atmospheric Vacuum Breakers

ASSE 1001

- Isolation
- Backsiphonage protection
  - No shutoffs downstream
  - Install 6" above highest point of downstream water outlet
  - Occasional water discharge
- Health hazar
- Non-continuo ressure
- Non-testable
- Vertical installation

Use: Process tanks, dishwashers, soap dispensers, washing machines, parlor sinks, irrigation systems



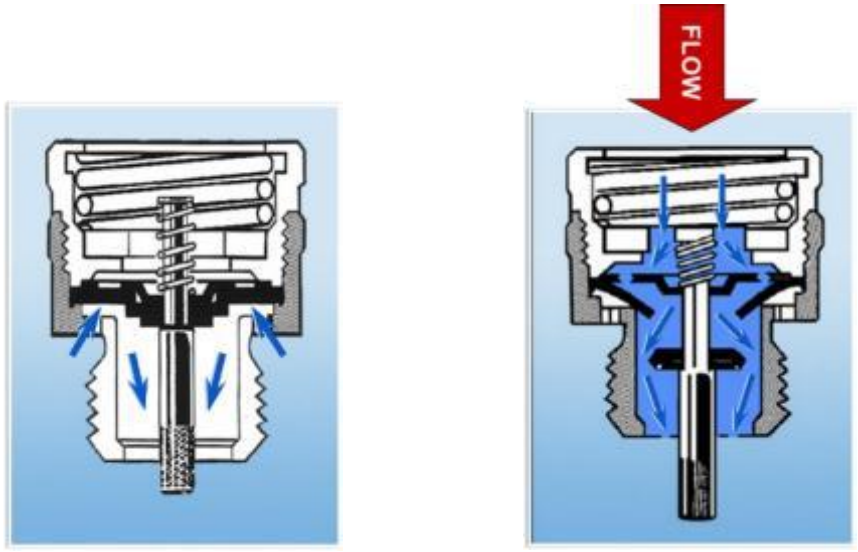


Hose Bibb Vacuum Breaker

ASSE 1011

- Isolation
- Backsiphonage protection
  - No backpressure beyond a 10 foot water column
- Health haza
- Non-continuous pressure
- Non-testable

Use: Hose bibs, service sinks, hydrants

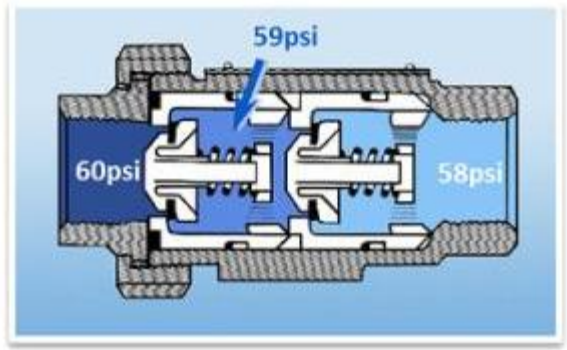


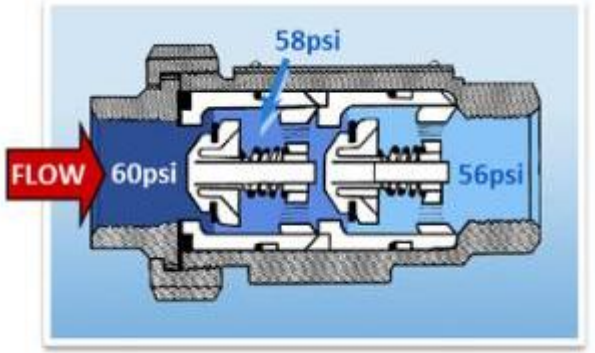
Dual Check Valve

ASSE 1024

- Containment
- Backsiphonage and backpressure protection
- Non-health haza
- Continuous pressure
- Non-testable
- Vertical and horizontal Installation

Use: Residential supply line (at the meter), hose bibbs, residential fire sprinkler systems

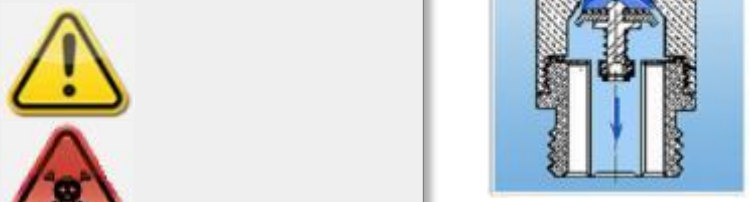


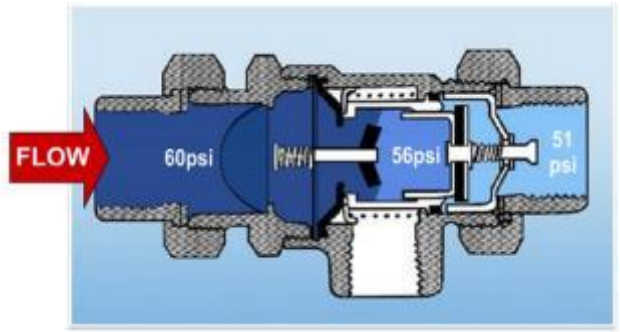


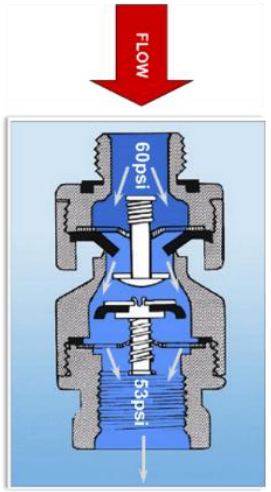
Dual Check Valve with Atmospheric Vent

ASSE 1052/1012/1035

- Isolation
- Backsiphonage and backpressure protection
  - Occasional water discharge
- Non-health hazard (1012)
- Health hazard (1052, 1035)
- Continuous pressure (1012)
- Non-testable
- Vertical and horizontal installation







Use: (1052) Sill cock, yard hydrant, wall hydrant, service sink, chemical dispensers; (1012) Boilers (small), wash down applications; (1035) Laboratory faucets, pipe lines, barber shop and beauty parlor sinks

Dual Check Valve - Carbonators

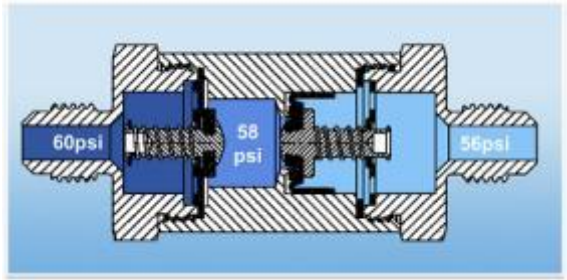
ASSE 1032/1022

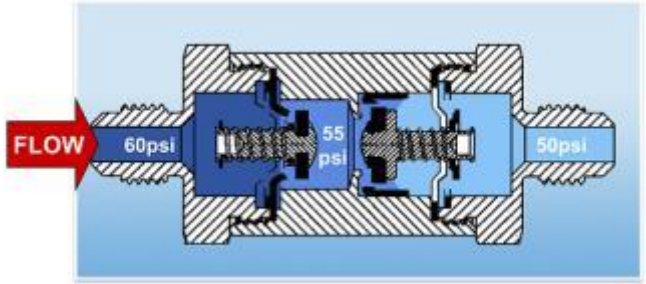
- Isolation
- Backsiphonage and backpressure protection

  - Occasional water discharge

  - Non-copper construction
- Non-health hazard
- Continuous pressure
- Non-testable
- Vertical and horizontal installation

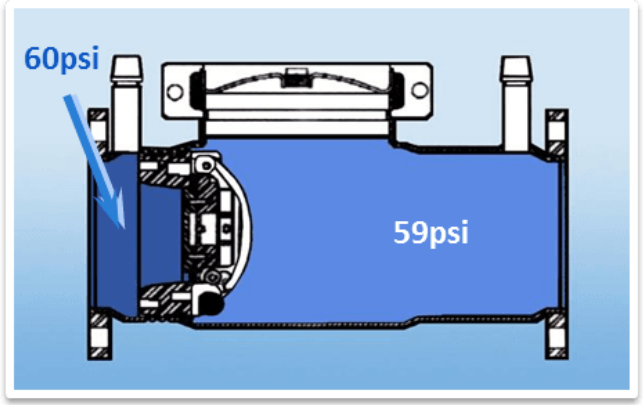
Use: Beverage machines, coffee machines, ice machines

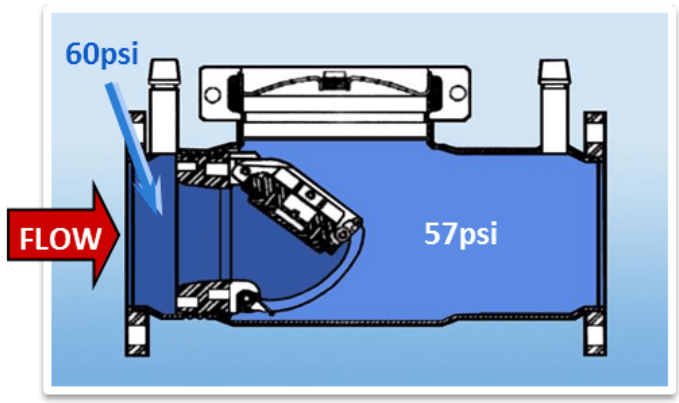




Single Check Valve Automatic Fire Sprinkler Systems

- Bypass kits with CFM or GPM meter
- Typical application:
  - Fire sprinkler lines where the water authority and fire inspector have specified a single check device.



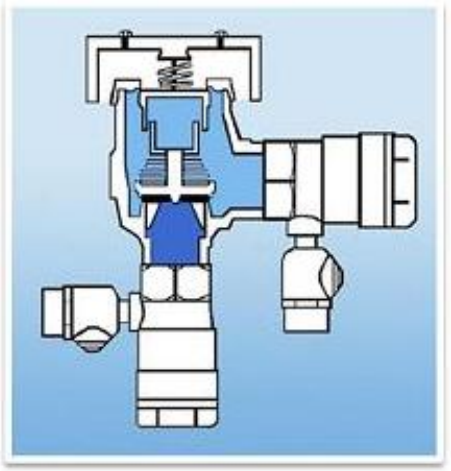


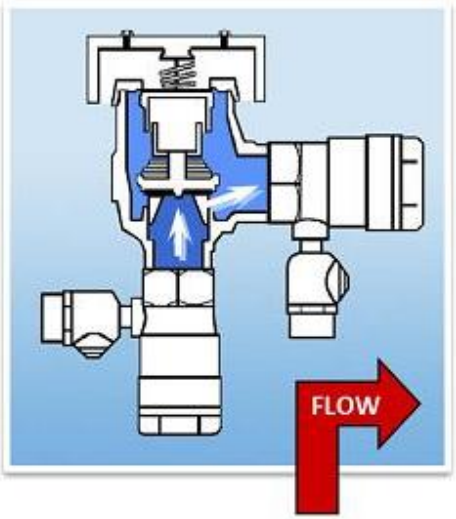
Pressure Vacuum Breaker

ASSE 1020

- Isolation
- Backsiphonage protection
  - Downstream shutoffs allowed
  - Install 12" above highest point of downstream water
  - Occasional water discharge
- Health Hazard 
- Continuous pressure
- Testable
- Vertical installation

Use: Laboratory equipment, cooling towers, commercial laundry machines, swimming pools, chemical plating tanks, irrigation systems



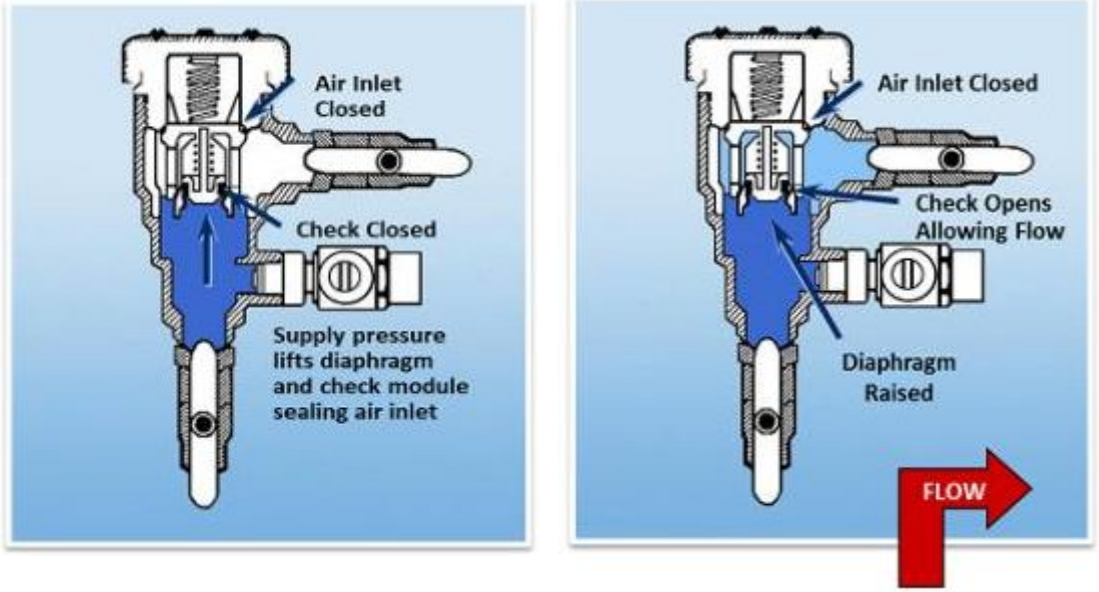


Spill Resistant Vacuum Breaker

ASSE 1056

- Isolation
- Backsiphonage protection
  - Factory installed / machine mounted
    1" above flood rim
  - Field installed 12" above flood rim
  - Downstrea utoffs allowed
- Health hazard
- Continuous pressure
- Testable
- Vertical installation

Use: Chemical dispenser, commercial dishwasher, sterilizers

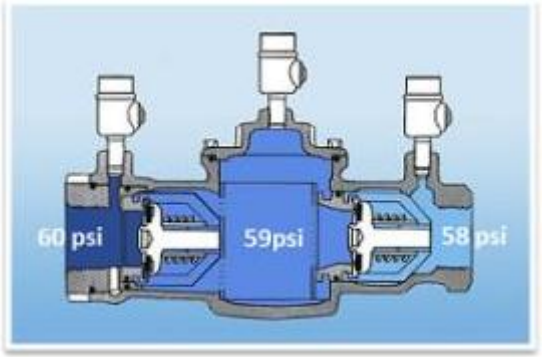


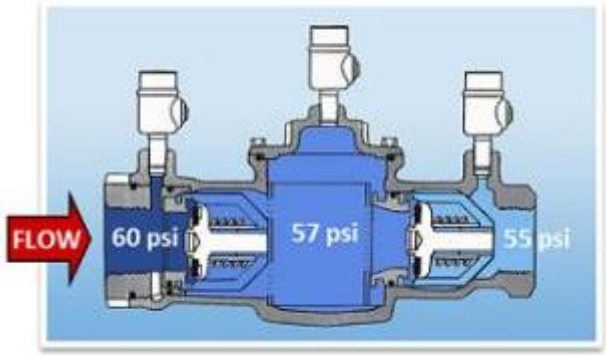
Double Check Valve Assembly

ASSE 1015

- Containment or isolation protection
- Backpressure and backsiphonage protection
- Non-health hazard
- Continuous pressure
- Testable
- Horizontal or vertical flow-up installations

Use: Main supply lines, food cookers, tanks and vats, commercial pools, irrigation, fire systems, industrial, chemical plant, pulp and paper industry, hospital, and corrosive atmospheres



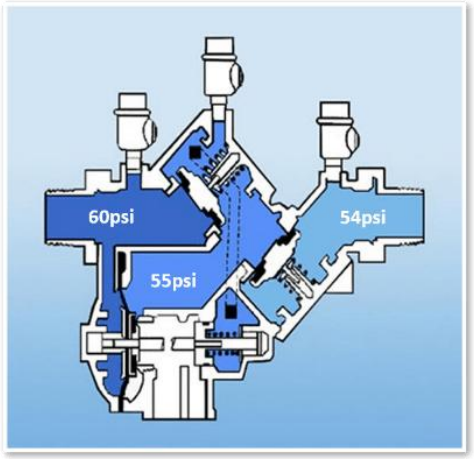


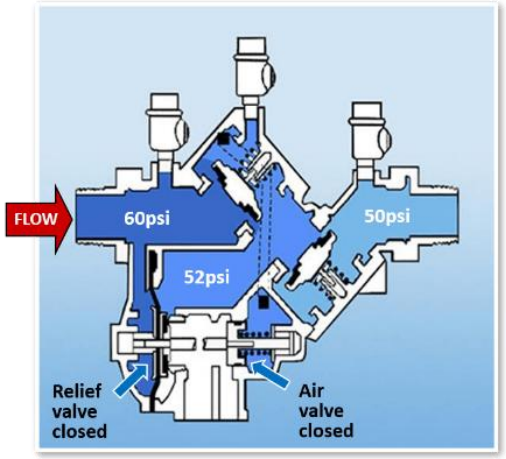
Reduced Pressure Zone Assembly

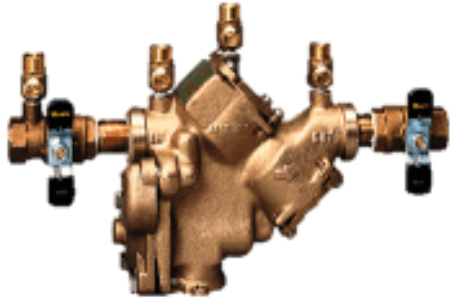
ASSE 1013

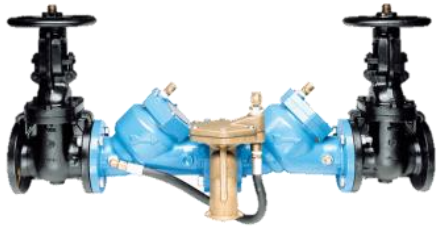
- Containment or isolation
- Backsiphonage and backpressure protection
  - Occasional water discharge
  - Install 12" above grade and allow space for normal testing and maintenance
- Health hazard
- Continuous pressure
- Testable
- Horizontal and some vertical installation

Use: Main supply line, irrigation, commercial boilers, waste digesters, car washes, hospital equipment, laboratory equipment, fire suppression systems







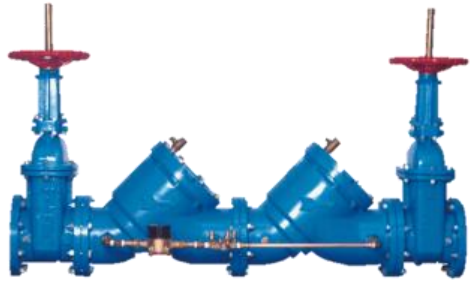


Double Check Detector Assembly

ASSE 1048

- Containment or isolation
- Backsiphonage and backpressure protection
  - Monitors unauthorized water usage
- Non-healt
- Continuous pressure
- Testable
- Horizontal and vertical installation

Use: Fire suppression systems



Reduced Pressure Detector Assembly

ASSE 1047

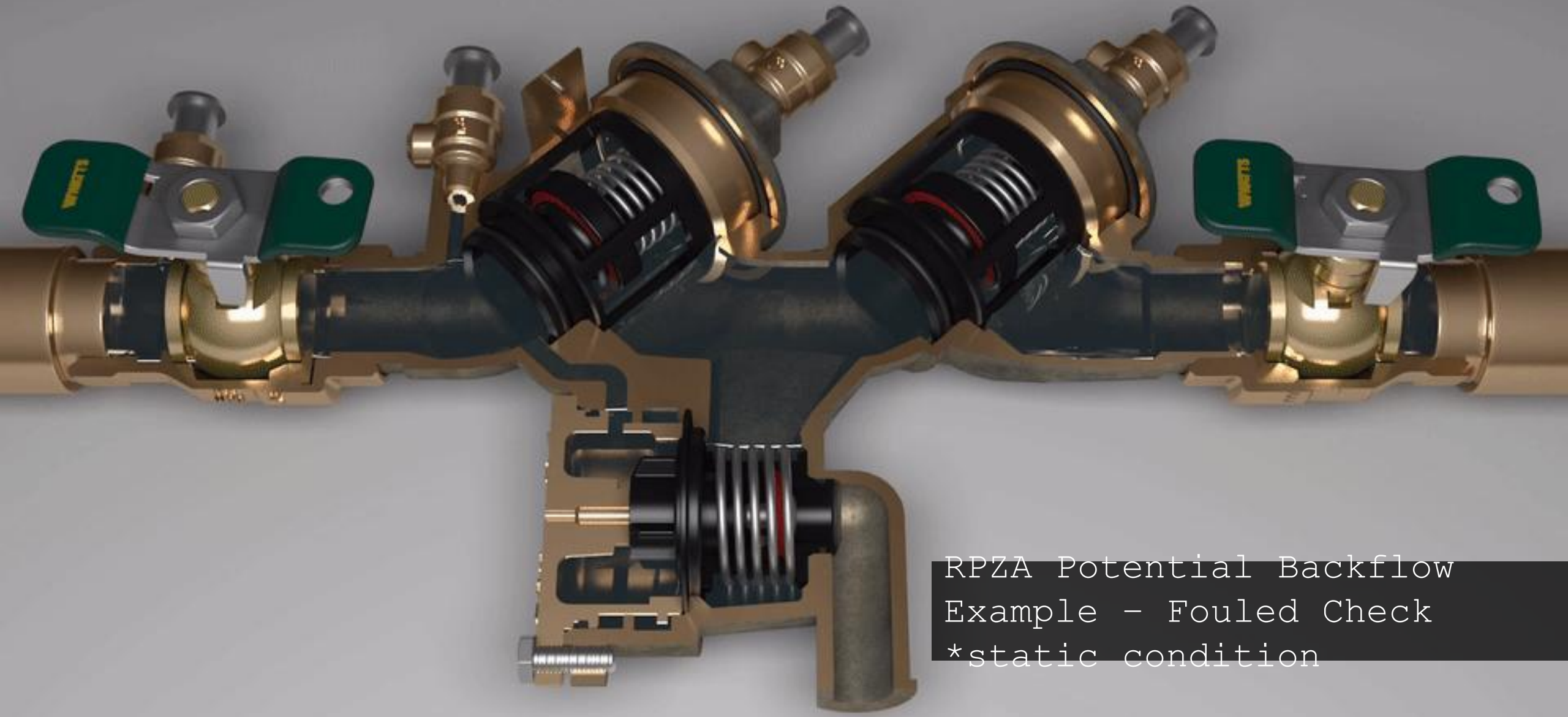
- Containment
- Backsiphonage and backpressure protection
  - Monitors unauthorized water usage
  - Occasional water discharge
  - Install 12" above grade, allow space for [illegible]mal testing and maintenance
- Health hazard
- Continuous pressure
- Testable
- Horizontal installation

Use: Fire suppression systems

How Backflow Works?

Normal RPZA Flow Example

How Backflow Works?



RPZA Potential Backflow Example - Fouled Check
*static condition

How Backflow Works?

RPZA Potential Backflow Example – Fouled Second Check With Backpressure Condition

Common Backflow Accessories

Strainer	Installed upstream of the backflow to prevent debris from entering the system and fouling or possibly damaging the BFP's check valves. (*Note: Always check with the water AHJ)	
Expansion Tank	The installation of a backflow preventer creates a closed system. Potable water expansion tanks are designed to absorb the increased volume of water created by thermal expansion.	
Spools	Used when retrofitting backflow preventers on different dimensions, eliminates costly on-site labor. Custom ordered with optional connections, flush ports, branches, or tees.	
Valve Setters	Valve setters are designed to augment the installation of the "N" series backflow prevention.	

Troubleshooting Backflows

Troubleshooting Assembly	Common Trouble Points	Common Issue: Relief Valve Steadily Discharging
• Troubleshoot the simple things first • Identify common trouble points • Full discharge or small amounts? • What is the line pressure? • Could there be freeze damage?	• Debris - Scale, sediment or corrosion • Check Valves - Sealing rubber, guides, or seats • Relief Valve - Sealing rubber, guides, seat, or diaphragm 	• Shut the outlet shutoff valve, monitor the relief valve discharge rate. • If the discharge stops, #2 check is faulty and backpressure condition exists. Clean or replace parts. • If discharge

Troubleshooting Backflows

Myths About Repairs	Facts About Repairs
• It takes longer to repair • Parts are too expensive • Too much training is needed • Never had good luck repairing an assembly • Assembly under warranty	• Assemblies are designed to be repaired inline • Knowledge and experience are required

Objectives

You should now be able to:

- Understand the importance of a backflow preventer to the protection and conservation of safe drinking water
- Describe Cross-Connection Control Programs and their importance to Total Backflow Protection
- Understand the backflow preventer selection criteria and how they work
- Understand the typical faults and failures associated with backflow preventers
- Understand the typical troubleshooting and maintenance solutions for backflow preventers

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- Scale Prevention Solutions

Drainage Solutions

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- Floor, Roof and Trench Drains
- Stainless Steel Drains

HVAC & Hot Water

- Boilers and Water Heaters
- Controls
- Floor Heating & Snow Melting

Water Leak Detection

- Commercial
- Residential

New Tech in Backflow Prevention

The Future is Now

Brad Kempski – Mid-Continent

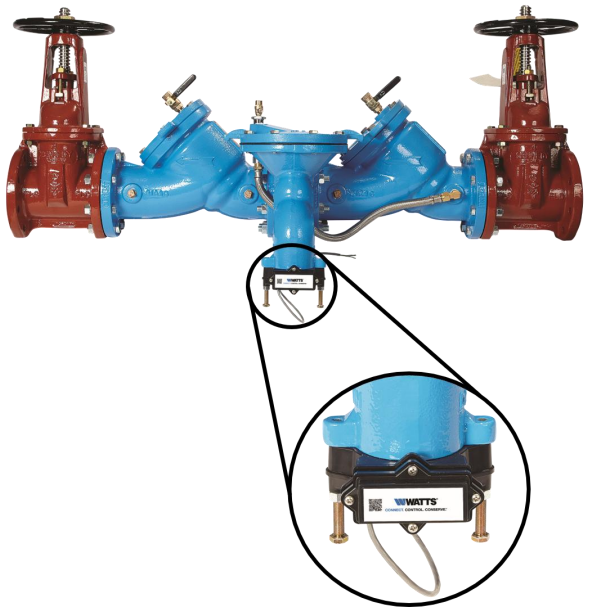
Course Objective

Upon successful completion of this course, you will be able to:

- Understanding the principals of continuous monitoring.
- Describe the available technologies, their advantages and applications.
- Become familiar with the various applications and installation considerations.

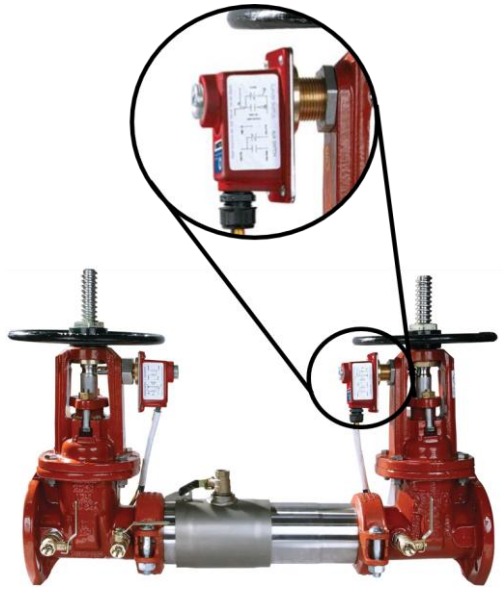
Backflow Prevention IoT Solutions

Leak / Flood Detection



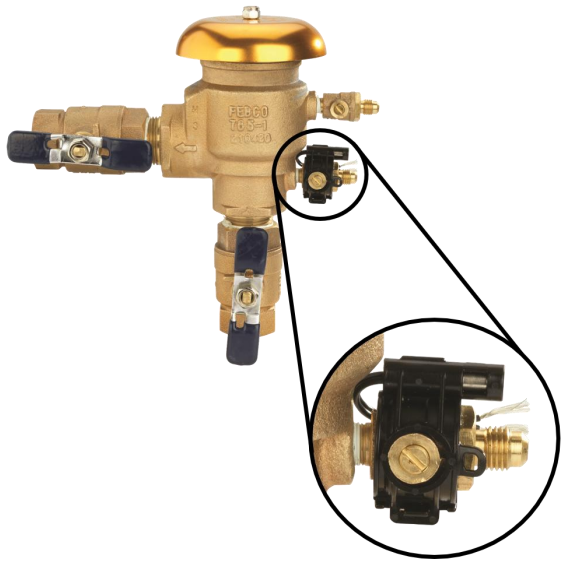
The add-on sensor connection kit is available for both third-party building management systems, or BMS, and cellular communication.

Fire / Tamper Detection



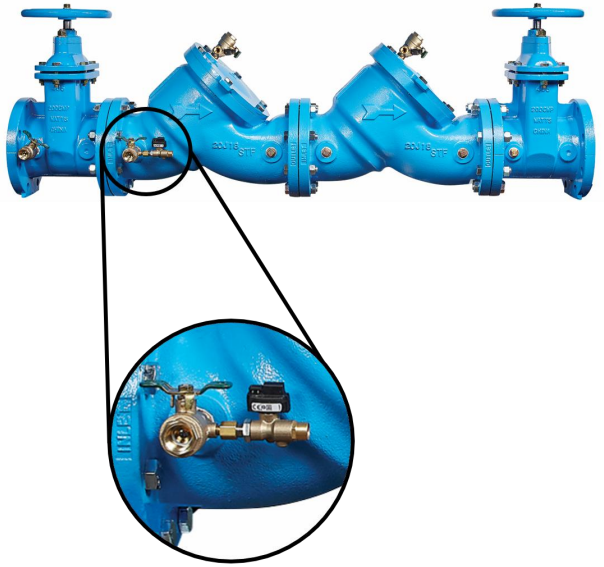
A Safety Device that indicates Open / Close position of OS&Y Gates in Fire Sprinkler Systems.

Freeze Detection



The add-on sensor connection kit, will provide you with advanced warnings of freezing conditions.

Performance Monitoring



Live pressure readings sent directly to BMS /BAS, track backflow performance, pressure changes and more.

What is IoT?

IoT DEFINED

The Internet of Things, or IoT, refers to the billions of physical devices around the world that are now **connected** to the internet, ***collecting and sharing data.***

The Demand for Smart & Connected Solutions is Surging.

What Does Smart & Connected Mean?

Smart & Connected are products, assets, and other things embedded with processors, sensors, software, and connectivity that allow data to be exchanged between the product and its environment, manufacturer, operator / user, and other products and systems.

SMART, CONNECTED SOLUTIONS HAVE SIX PRIMARY COMPONENTS

1 A PHYSICAL DEVICE

The Product or System being connected.

2 AN EMBEDDED TECHNOLOGY

A controller with an operating system.

3 A GATEWAY OR NETWORK

A device or system allowing cloud connectivity.

4 CLOUD COMPUTING & STORAGE

Physical Servers with computing and storage capability that communicate to gateways and the user interface.

5 A USER INTERFACE

A device or software managed by the end user allowing access to Cloud information and / or device.

6 DATA ANALYTICS

Reading and transforming data with the goal of discovering information and drive decision making.

Why Smart & Connected?

Major Drivers – Next 5 Years

Sustainability & Conservation - There is a [drinking] water main break every two minutes and an estimated 6 billion gallons of treated water lost each day in the U.S. enough to fill over 9,000 Olympic sized swimming pools.

Human Expertise - Some utilities expecting as much as half of their staff to retire in the next 5 to 10 years.

Safety - Growing awareness of hazardous waste in potable water and fire suppressing chemicals being used in fire sprinkler systems.

Demographics and Technology Driving the Change

Industrials: Chemicals & Hazardous Material

Healthcare – Hospitals, Clinics, Dentist offices

SCV WATER
SANTA CLARITA VALLEY WATER AGENCY

Municipalities & Purveyors

Advantages of Continuous Monitoring

Reduce Response Times

- Real time monitoring of multiple backflows and locations.
- Discharge Event mitigation.
- Reduce risk of property damage.
- Water conservation & sustainability – Green Initiatives.
- Insurance cost reduction.

Conservation

- How much time goes by before an RP discharge is noticed? Days? Weeks?
- How much water loss per minute on a 4”-8” valve? – 240 GPM to 950 GPM.
- Excessive water use fines vary by state - in CA, NV, AZ - $50 to $5,000 per incident.

Civil Engineering Advantage

- More and more RPZ’s are being spec’d.
- Flood Sensors provide specification of a water conserving solution.
- Help Meet sustainability and green initiatives.

Fire Sprinkler Codes

- How long can a fire main be non-operational?

  *The NFPA requires a fire watch to be implemented if a commercial system is down for more than **four hours** in a 24-hour timeframe..*

- Fire Sprinkler Codes Violations - $50 - $200 a day!

The American Society of Civil Engineers (ASCE) supports water conservation and water use efficiency measures as essential elements of sound water resources management. ASCE encourages suppliers, regulators, legislators, and consumers to support laws, regulations, policies, and programs for water conservation.

Cost of Flood Damage

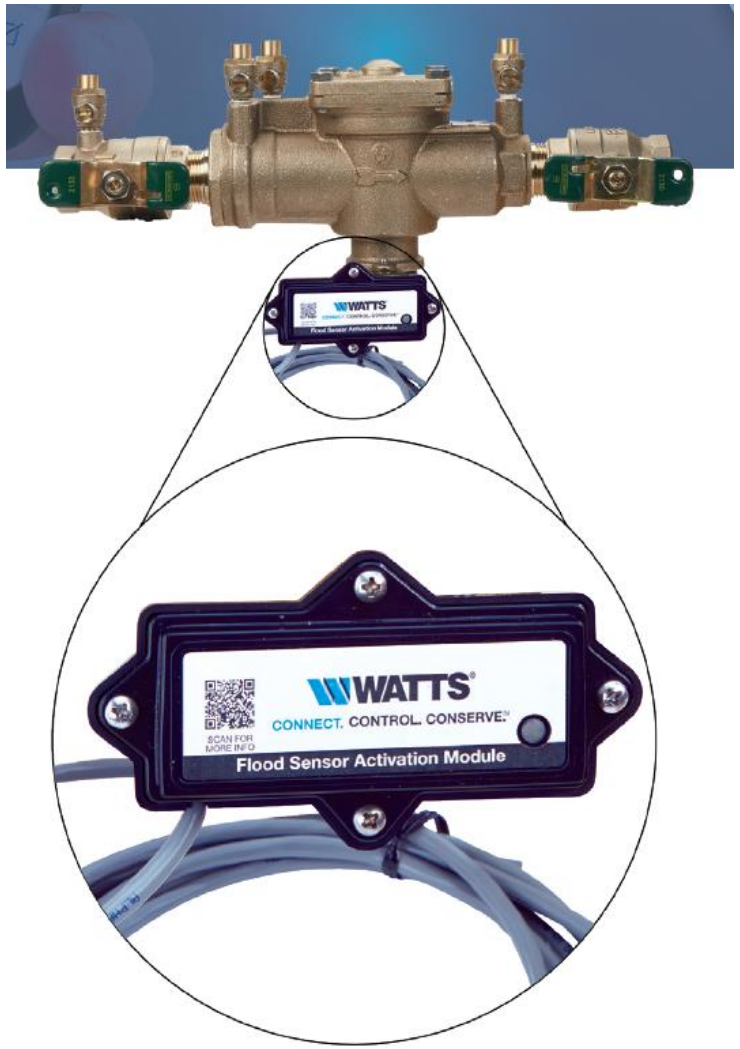
The Challenge

Water damage is the #1 cause of property damage

- Larger than fire and theft combined.
- The average commercial flood costs upwards of $75,000.
- Mold can add 10X to claim.
- Leaks can happen 24/7 – and often go undetected.

New: Backflow RPZ’s with Flood Sensor Technology

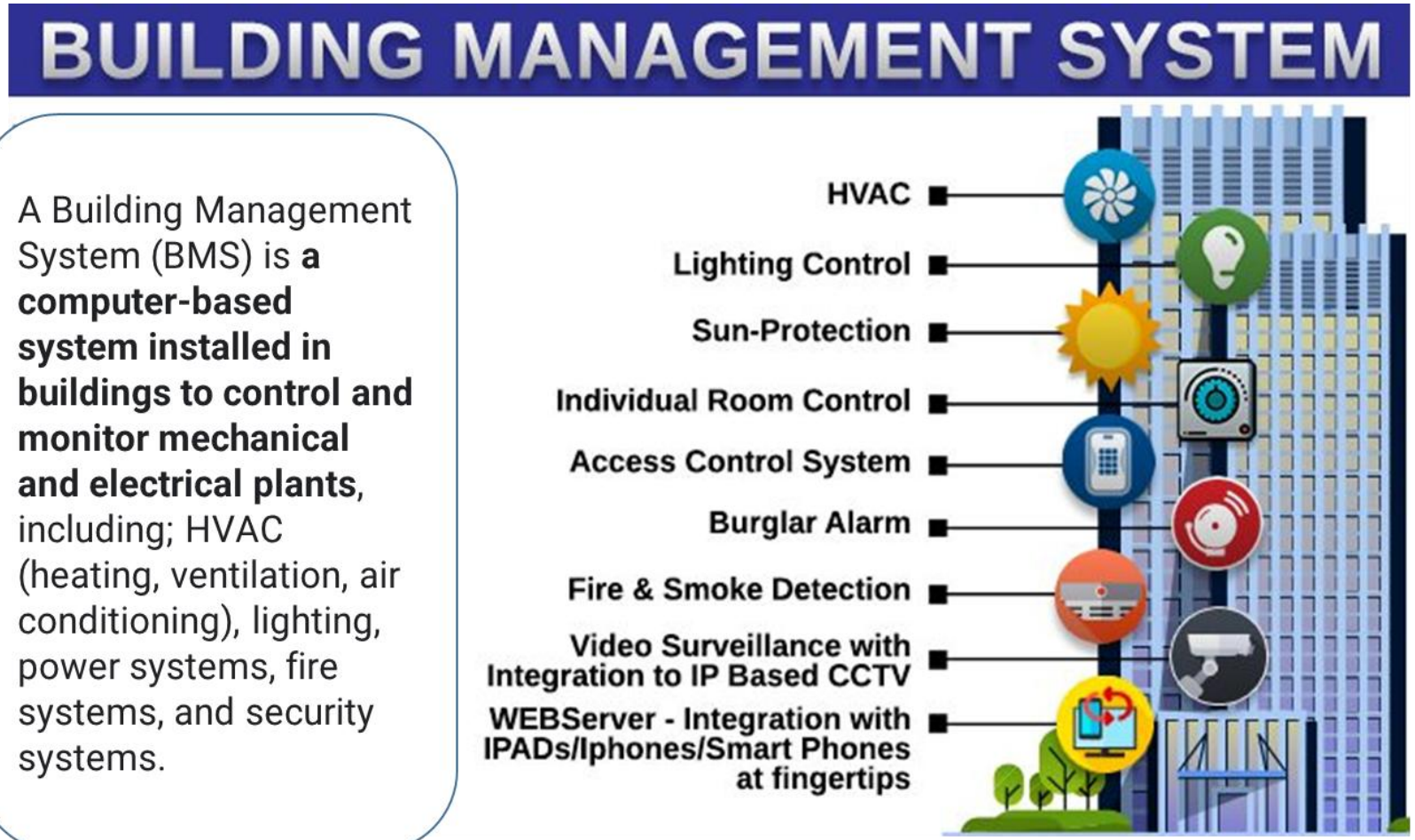
- Same RPZ assemblies' high reliability Backflow Prevention with, new integrated technology.
- Includes an integrated flood sensor with Flooding sensor Technology for reliable flood detection.
- Activate flood sensor technology with add-on activation kits.



The add-on sensor connection kit is available for both third-party Building Management Systems (BMS), and cellular communications.

What is a Building Management System?

A Building Management System (BMS) is **a computer-based system installed in buildings to control and monitor mechanical and electrical plants**, including; HVAC (heating, ventilation, air conditioning), lighting, power systems, fire systems, and security systems.



- See real time data
- Configure historical data
- Send Alerts / Alarms

Flood Sensor BMS Kits

https://www.watts.com/floodprotectionsystem

Upgrade Backflows that already have sensors.

Sm. Dia. WATTS 009 ½” - 3”

Sm. Dia. FEBCO 860 ½” - 2”

Upgrade Backflows that don’t have sensors.

Sm. Dia. WATTS 009 1” – 1 1/2”

Sm. Dia. FEBCO 860 ½” - 2”

BMS Sensor Connection Kit

- Use this kit to activate the integrated flood sensor and enable flood detection capabilities for your valve.
- Includes a sensor activation module, deflectors and power supply.

BMS Sensor Retrofit Connection Kit

- Use this kit to add flood detection capabilities to your existing valve which doesn’t already have a sensor.
- Includes a sensor activation module, power supply, sensor, O-ring, deflectors and hex bolts.

Flood Sensor Cellular Kits

https://www.watts.com/floodprotectionsystem

Upgrade Backflows that already have sensors.

Sm. Dia. WATTS 009 ½” - 3”

Sm. Dia. FEBCO 860 ½” - 2”

Upgrade Backflows that don’t have sensors.

Sm. Dia. WATTS 009 1” – 1 1/2”

Sm. Dia. FEBCO 860 ½” - 2”

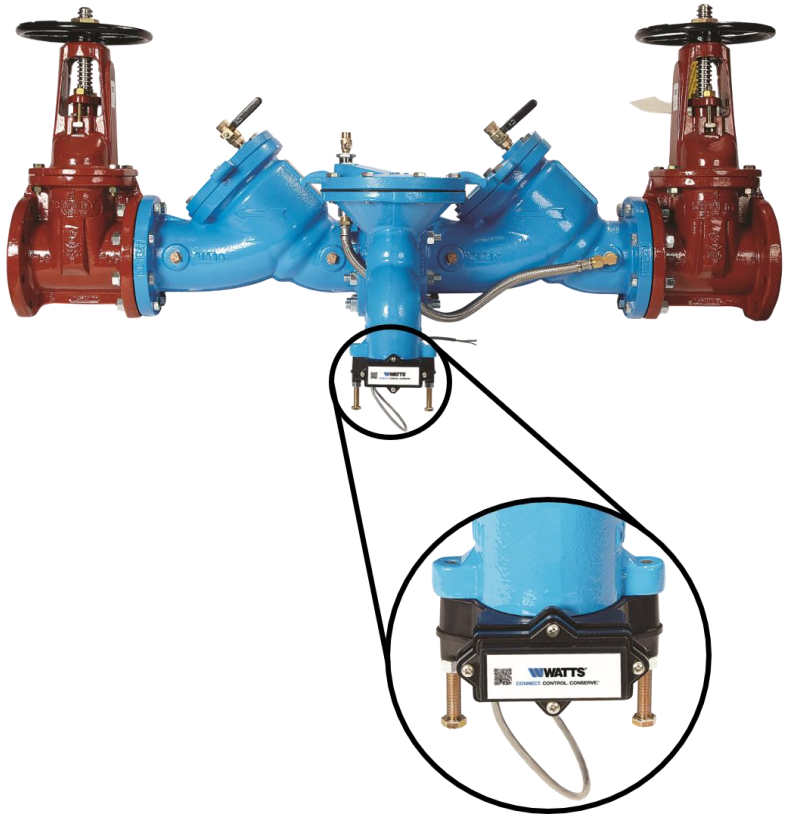
Cellular Sensor Connection Kit

- Use this kit to activate the integrated flood sensor and enable flood detection capabilities.
- Includes a sensor activation module, cellular gateway, deflectors, and power supply.

Cellular Sensor Retrofit Connection Kit

- Use these kit to add flood detection capabilities to your existing valve.
- Includes a sensor activation module, cellular gateway, deflectors, power supply, sensor, O-ring, and hex bolts.

Get Peace of Mind with Reliable Flood Detection

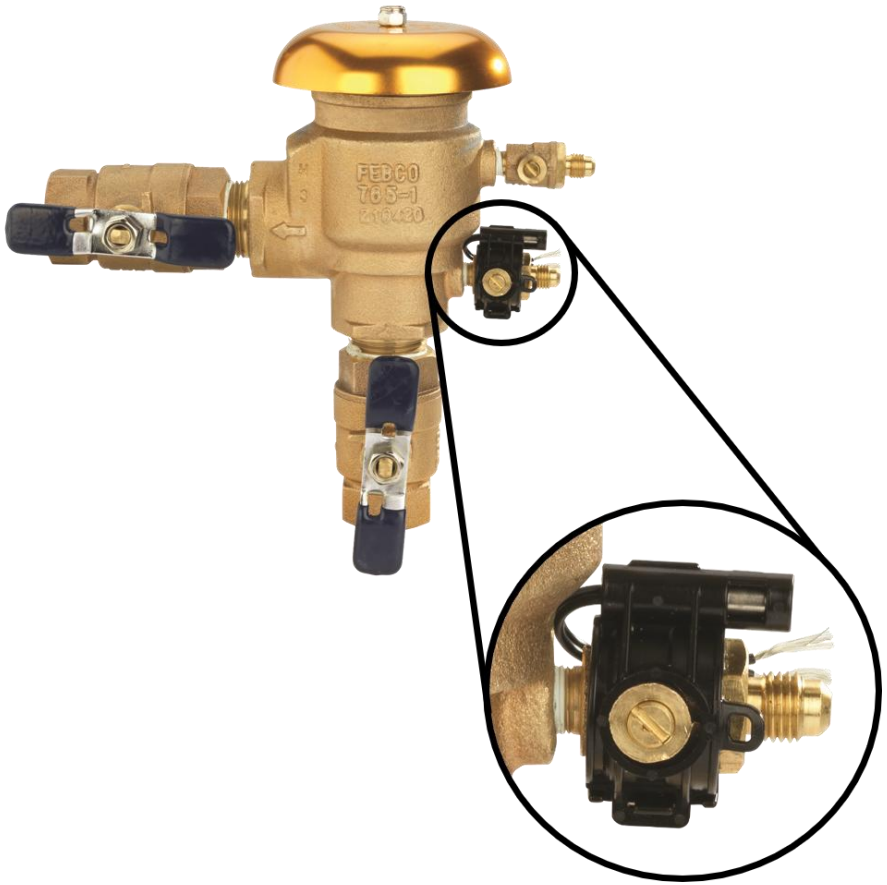


24/7 monitoring detects potential flood conditions.

Real-time alerts sent via phone, text, and email.

Saves you money, time, and stress of dealing with disastrous floods.

Why Freeze Detection?



The Challenge

Freeze is a costly problem and the #1 cause of PVB damage.

- Freezing and Cracking
- Loss of Functionality
- Leaks
- Contamination Risk

New: SentryPlus Alert ® Technology for PVB's and DC's

New Wi-Fi Solution

- Built-in Wi-Fi function to communicate freeze alerts directly to the user, eliminating the need for a third-party controller.
- Included standalone sensor to provide flexibility for measuring temperature at or near any water-carrying outdoor installation vulnerable to freezing conditions.
- Switched output relay to connect to BMS or irrigation management systems or used to activate a solenoid.

The add-on freeze sensor connection kit is compatible with Irrigation Management Systems (IMS), Building Management System (BMS) and Wi-Fi networks.

Direct Alert To Multiple Users (Contractor, Building Owner, Service…)

How it Works

What makes it smart

- Senses the temperature from standalone sensor or sensor mounted on Backflows.

- The activation module is designed with relay controlled temperature and time delays.

  - ✓ **Alert #1 – Low Temperature Alert** is issued if temperature is measured below below 37°F after two hours. Reminder every 12 hours.
  - ✓ Normal operation resumes when temperature is measured above 37°F.

  - ✓ **Alert #2 - Freeze Temperature Alert** is issued if temperature is measured below below 32°F after two hours. Reminder every 12 hours.
  - ✓ Temperature alert and reminders are issued accordingly when temperature is measured above 32°F.

Usable with Watts backflows or with any other freeze sensitive product

Beyond Backflow:

- *Fire Sprinkler System Pipe Lines*
- *Heated Mechanical Rooms*
- *Outdoor installation of valves and other water carrying equipment*
- *Hot Box heater monitoring*
- *Pipes installed in building risers*

Connectivity Kits – Watts & Febco

Kits can be integrated by qualified technician to local Building Management Systems (BMS) or Irrigation Management System (IMS) and Wi-Fi networks.

Upgrade WATTS PVB's and DC's that already have sensors or that don't have sensors.

007
007M1DCDA
LF007
SS007
800M4FR
800M4QT
LF800M4FR
LF800M4QT

Identical kits being sold through separate channels.

https://www.watts.com/freeze-detection

Upgrade FEBCO PVB's and DC's that already have sensors or that don't have sensors.

765
850
LF850

Wi-Fi/BMS/IMS Sensor Connection Kits
For WATTS PVB's and DC's Sizes ½" to 2"

- Use this kit to activate either freeze sensor and enable freeze detection capabilities for your valve.
- Kit contains the sensors activation module and mounting hardware, wire nuts and power supply. Additionally, all kits include both freeze sensors to retrofit existing valves.

Wi-Fi/BMS/IMS Sensor Connection Kits
For FEBCO PVB's and DC's Sizes ½" to 2"

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Freeze Sensor Kit Components

Requirements

- 120VAC, 60Hz, GFI-protected electrical outlet (for kit power adapter), or 5V power source.
- Two custom lengths of 2-conductor cable (sprinkler wire).
  - One length to connect the freeze sensor to the activation module.
  - The other length to connect the activation module to the BMS or IMS.
  - When Wi-Fi enabled, notifications can be issued through the Smart Freeze Alert cloud service.

Watts is not responsible for the failure of alerts due to connectivity or power issues.

Activation Module with Vent and Mounting Hardware

5V DC Power Supply

Wire Nuts

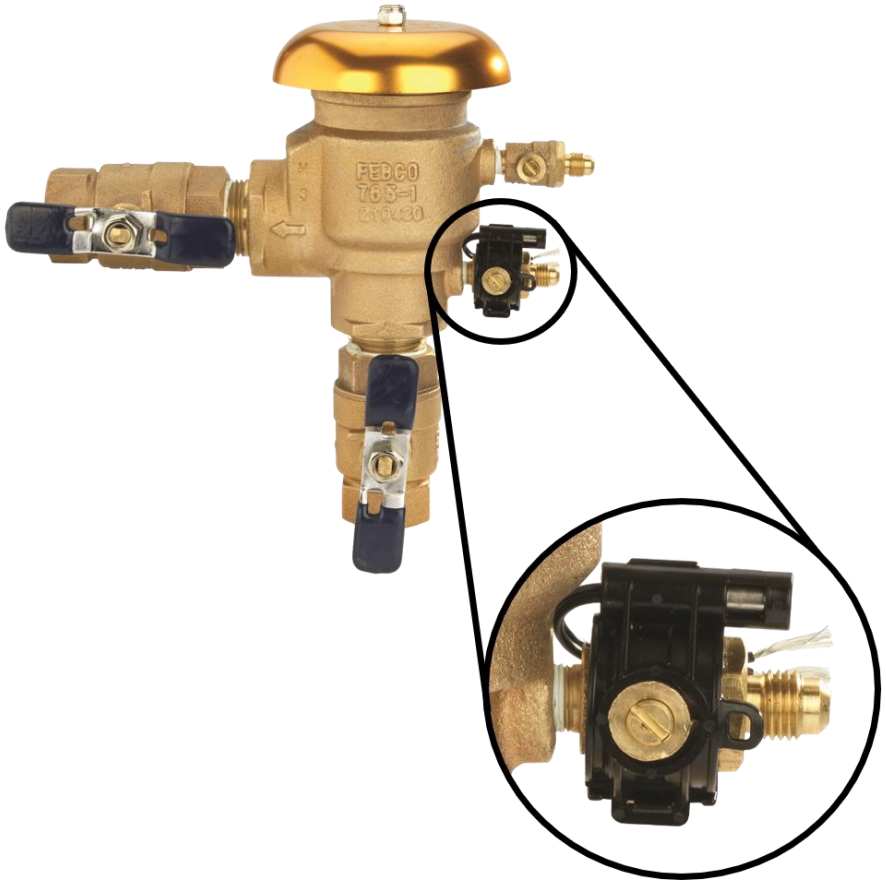
Freeze Sensors with Mounting Clip

Get Peace of Mind with Reliable Freeze Protection

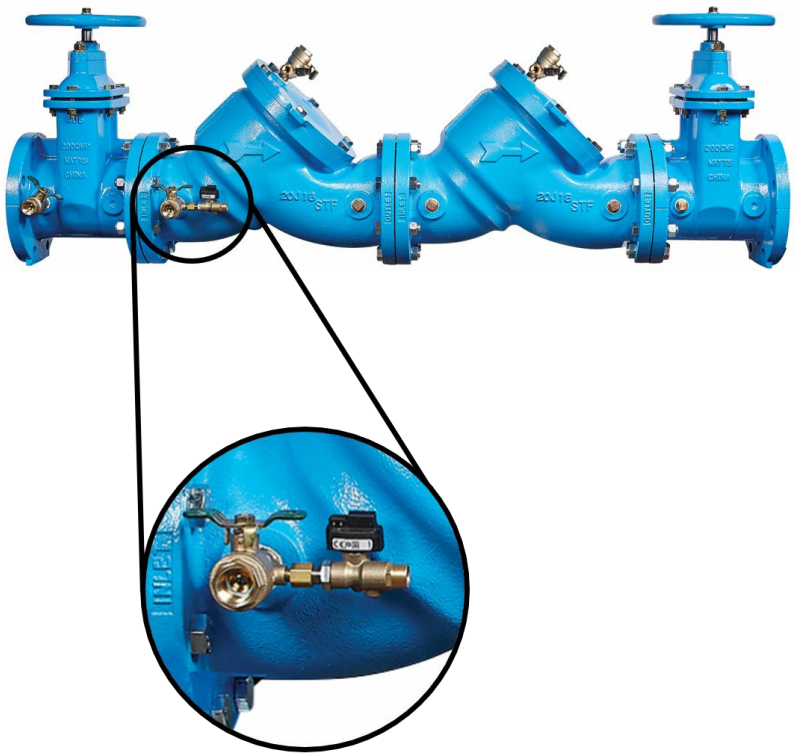
Monitor Backflow Preventer 24/7
Receive real-time alerts when freezing conditions are detected.

Prevent Freeze Damage
Replacing a cracked backflow preventer is costly and time-consuming.

Reduce Water Waste
Avoid the mess of flooding that follows freeze damage.



Performance Monitoring



Next Generation of Sustainability

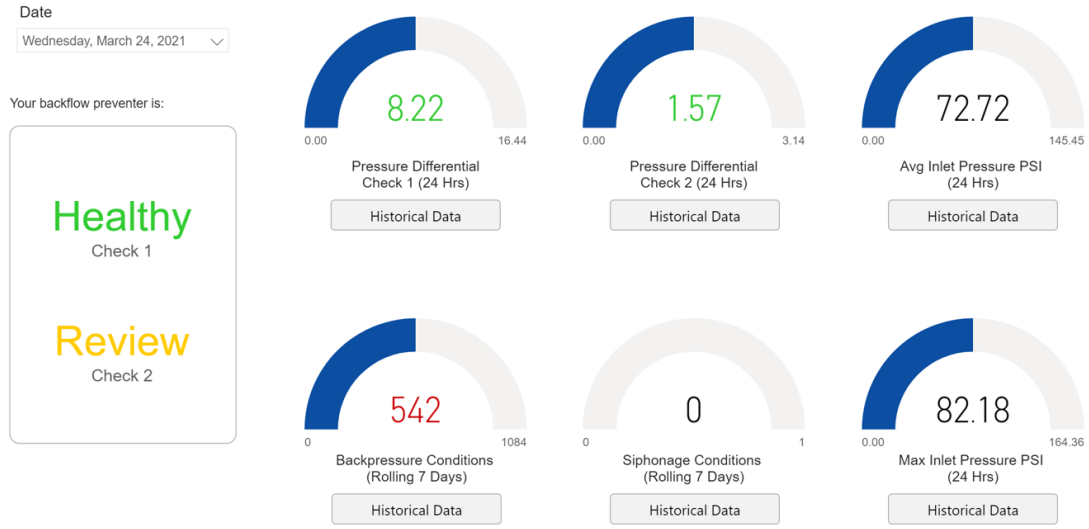
24/7 Performance Monitoring

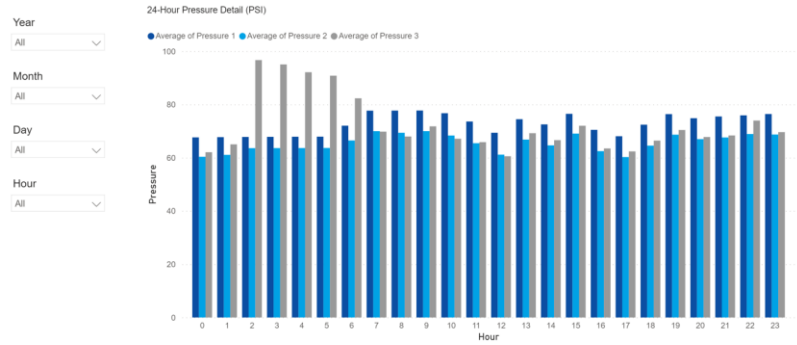
- Live pressure readings sent directly to BMS/BAS.
- Three sensors give a full picture of backflow health.
- Identify potential issues before they become a major health event.
- Reduce workload associated with visual monitoring.
- Identify unauthorized water system usage.

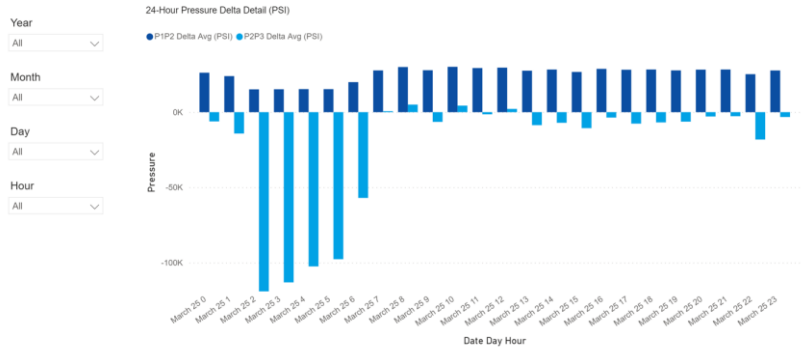
Peace of mind for operators of water systems.

Real Time Monitoring

- Three sensors allow for customers to view check differentials in real time.
- Powerful BMS interfaces allow for customized dashboards using pressure data.
- Modbus RTU communication protocol compatible with all major BMS/BAS communications.







Data sent over RS-485 in Modbus RTU communication format.

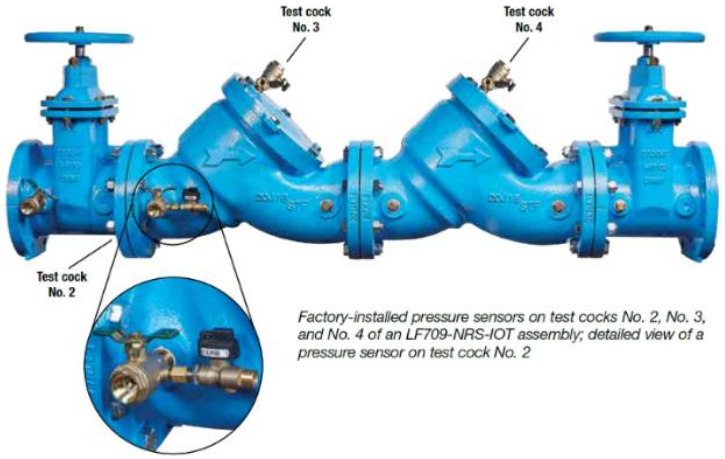
Pressure Monitoring Summary

Pressure Sensors Installed on Back Flow Constantly Monitor Change in Pressure.

An Analog to Digital Converter (ADC) is used to receive information from the Pressure Sensors using the Upgrade kit.

After Receiving the analog information, the ADC converts it into Modbus and transmits to BMS.

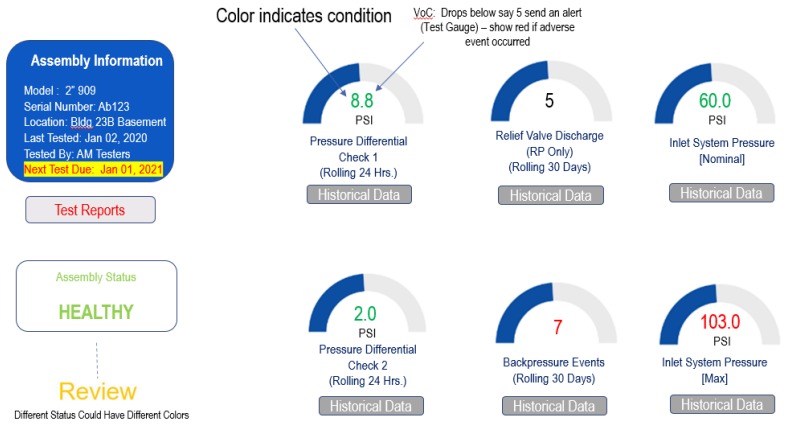
Using the Data, information can be displayed in various ways within BMS. This requires a BMS integrator technician.



Factory-installed pressure sensors on test cocks No. 2, No. 3, and No. 4 of an LF709-NRS-IOT assembly; detailed view of a pressure sensor on test cock No. 2

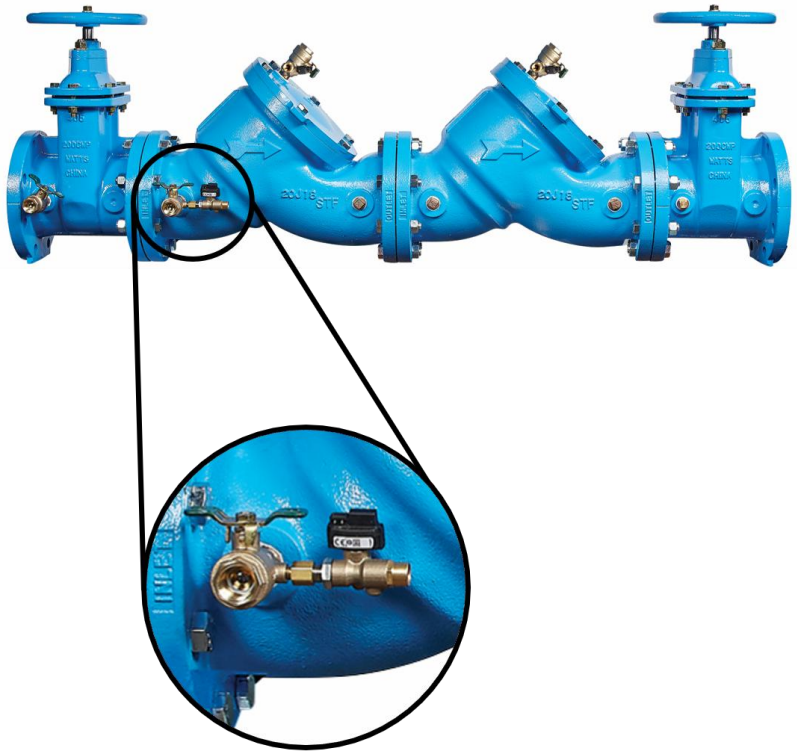
Factory installed on Backflow

BMS ADC Upgrade Kit



Example BMS Screens

Get Trustworthy and Reliable Performance Monitoring



24/7 performance monitoring.

Monitoring connection kit integrates with BMS.

Avoid expensive surprises with real-time visibility.

What is a Tamper Switch?

- **The switch must be able to signal both tampering and closure of the valve.**
- Device should be securely mounted to an OS&Y device.
- Used to detect unauthorized operation of a main control valve in a sprinkler or standpipe system.
- Codes require that all fire service system valves be supervised.
- Capable of transmitting an electrical impulse to activate audible or visual alarm.
- Switches should operate within two rotations of the valve handle or when the valve stem has moved 20% from its normal operating position.

A Safety Device that indicates Open / Close position of OS&Y Gates in Fire Sprinkler Systems.

Tamper Solutions – Chains / Bracket Mounted / Integrated

Chains are common in US Market

Integrated Butterfly Tamper Switches

Bracket Mounted Tamper Switch

- **Often requires 2-3 people to install**
- **Requires filing grove into stem**
- **Seems finicky and easily moved**
- **Vibration can sometimes set it off**
- **Difficult Time calibrating “Getting it Right”**

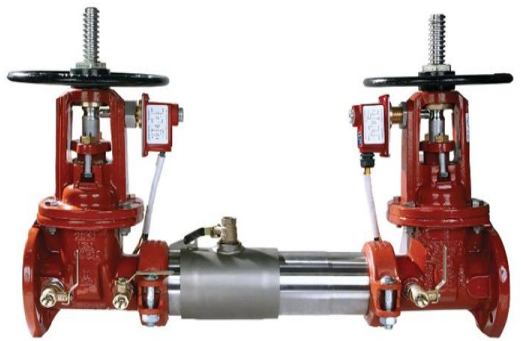
Field Installation can be Time Consuming!

New! Integrated OS&Y Tamper Switch

Features and Benefits

- Rigid Mounting – Integrated with the Valve. No brackets to adjust or tighten
- Factory Installed – Calibrated and tested
- Simple Install – No mechanical installation required
- External field adjustment if required or needed
- Maintenance – same warranty as valve, field repairable and replaceable
- Meet Fire Codes (UL / FM)

Factory Installed, Calibrated, Tested and Ready to Go



Factory Installed, Calibrated and Tested	Continuous Monitoring Via BMS	Save Time

Get Peace of Mind with Factory Installed Tamper Switches

Stay Connected

Continuously monitor your valve for fire tampering through your BMS system.

All-in-One Purchase

Purchasing a backflow preventer with a tamper switch already installed means one less purchase to deal with.

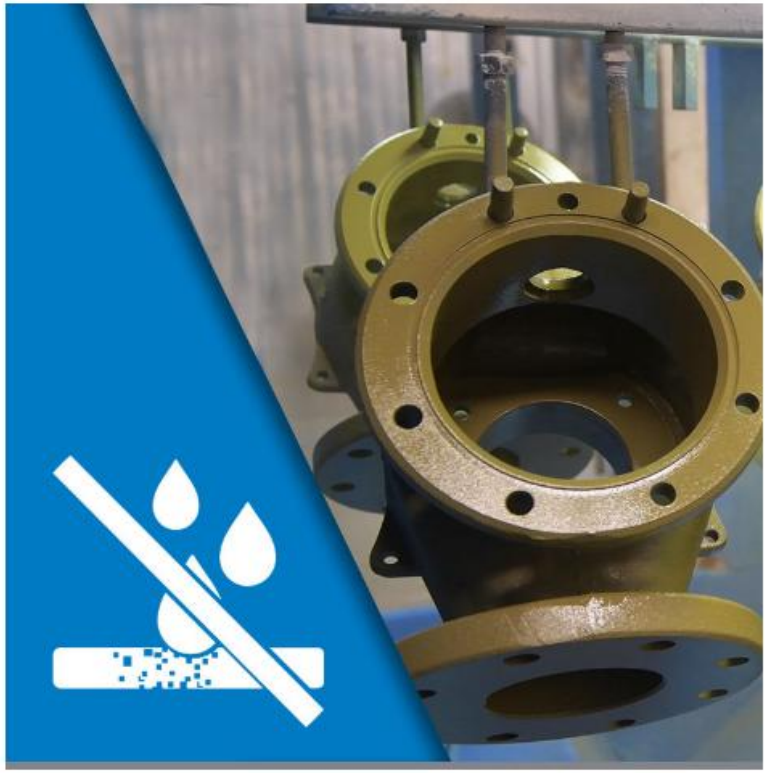
No More Headaches

Having fire tamper detection already installed and calibrated means less frustration in the field.

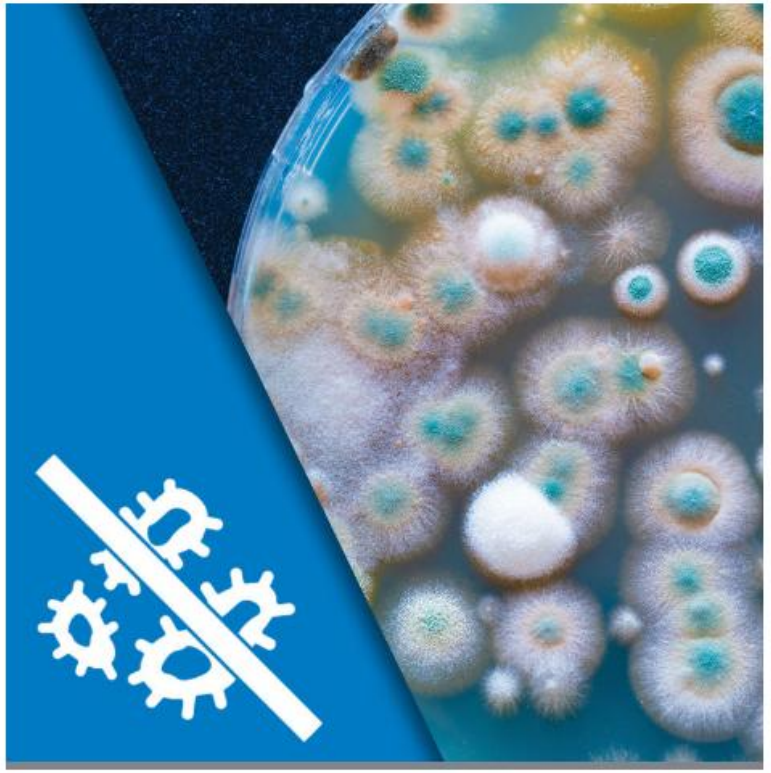
ArmorTek - Advanced Coatings

ArmorTek does not contribute PFAS to the water

Three-Pronged Approach to Corrosion Protection



Anti-corrosion Primer



Microbial Inhibitor

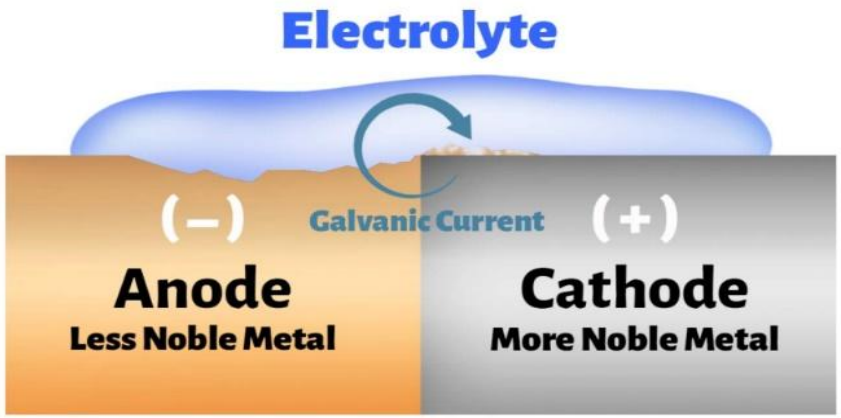
Robust Topcoat

ArmorTek is applied to all WATTS and FEBCO Large Diameter Valve Bodies

ArmorTek’s - Anti-Corrosion Primer

First Coating - Galvanic Corrosion Inhibitor

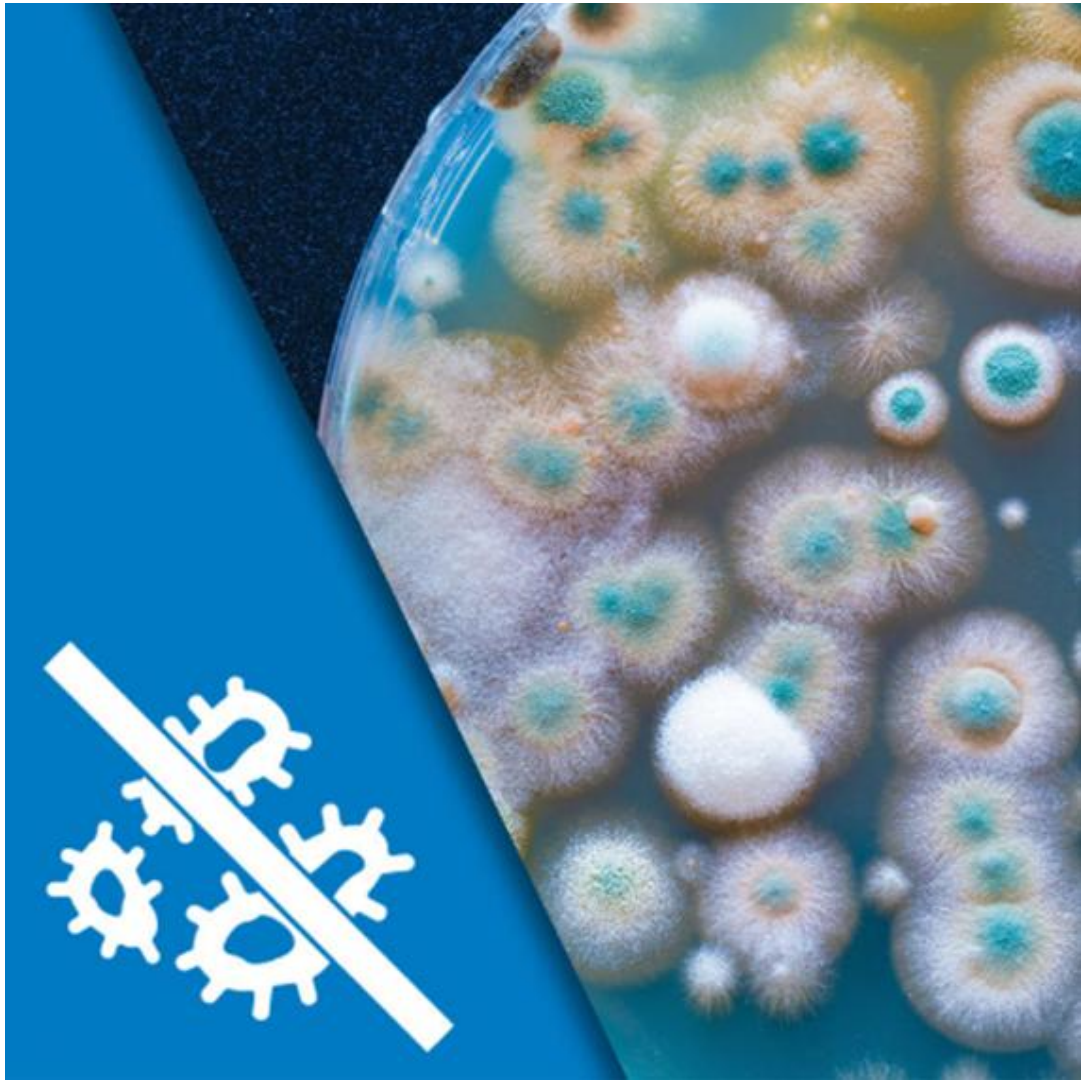
- Contains a galvanic corrosion inhibitor.
- Utilizes the same principle as the anode rods in water heaters.
- Forms galvanic cell with iron and water, protecting the iron.



ArmorTek’s - Microbial Inhibitor

Included in First Coating - Microbial Inhibitor

- Built into the coating.
- Inhibits the growth of bacteria that causes MIC.
- Testing has shown that it can effectively kill microbes in static conditions.



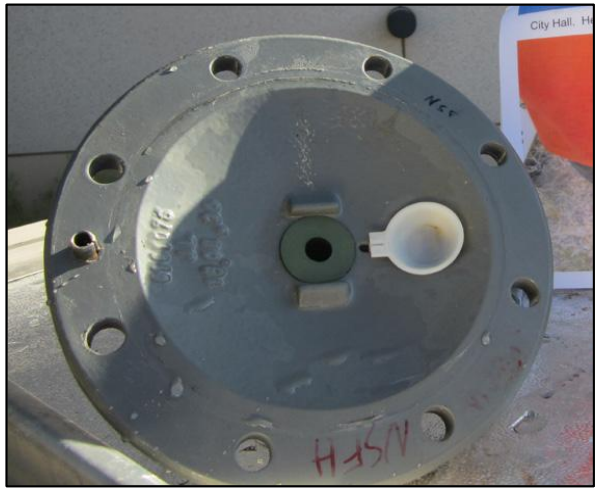
ArmorTek’s – Robust Topcoat

Second Coating – Epoxy

- The same color epoxy coatings you are familiar with.
- Primer is specially formulated to bond with the topcoat.
- Can give wear indication when worn through to the primer coat (yellow-green).

Field Test Results

Field-Proven Protection



Traditional Coating: 14 months

In these images taken 14 months after installation you can see many of the tubercles common to MIC and extensive corrosion.

ArmorTek's Advanced Coatings: 16 months

These images taken after 16 months in the same application as above shows little to no corrosion. Any corrosion resulting from a breach in coating has not spread.

Field Proven Protection

https://www.watts.com/search?searchterm=ArmorTek%20in%20Las%20Vegas%20Five%20Years%20After%20Install

Press ctrl + left mouse click

ASTM Tested and 5 Years of Field Testing

Standard Coating

ArmorTek Coating

Three-Pronged Corrosion Protection Solution

Anti-Corrosion Primer

Significantly slows the spread of corrosion.

Microbial Inhibitor

Prohibits the growth of the bacteria that causes MIC.

Robust Topcoat

Provides a high strength barrier between the iron substrate and water.

WATTS WORKS

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  - St. Pauls, NC
  - Woodland, CA
  - Burlington, Ontario
  - Fort Worth, TX

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