

# Cross Connection Protection Devices

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## *Four questions to ask before installing a BFP -*

- 1) Is the application a high hazard or low hazard?*
  - 2) Will the device encounter backsiphonage conditions?*
  - 3) Will the device encounter backpressure conditions?*
  - 4) Will the device be subjected to continuous or intermittent pressures?*
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In the past twenty years, great strides have been taken to protect our potable water supplies, and ultimately public health, through the advancement of mechanical cross connection protection devices, more commonly referred to as backflow preventers.

What is a backflow preventer? A backflow preventer is “any mechanical device, whether used singly or in combination with other controls, designed to automatically prevent an unintentional reversal of flow in a potable water distribution system.” This article is intended to overview the different types of backflow preventers currently used in the industry and explain their differences.

### **Air Gaps**

An air gap in a water supply system, as defined in the Plumbing Dictionary, is the unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank or plumbing fixture and the flood-level rim of the receptacle. The distance is generally two (2) times effective diameter of the supply pipe, but is not less than one (1) inch.

An air gap is the most method to the backflow of non-potable water into the potable water system. A properly installed air-gap separation does not allow for the existence of a cross connection in a piping system, as it creates a physical break between the potable water supply and a potential source of contamination or pollution. Unlike the other devices described in this article, an air gap is not a mechanical method of backflow prevention; however, it should be inspected periodically to ensure that the physical separation has not been closed in any manner (i.e.: addition of a hose or additional piping extending the supply outlet to below the flood level rim of the receptor).

Typical installations include lavatories, process tanks, sinks, dishwashers and cooling towers.

The standards for air gaps are the ASME/ANSI A112.1.2, ASME/ANSI A112.1.3 and ASSE Standard #1021.

### **Anti-Siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks**

Anti-siphon fill valves, formerly referred to as ballcocks, are water supply valves installed to deliver potable water to a water closet flush tank. It includes an integral vacuum breaker, or other approved backflow preventer, or is designed to provide an air gap when installed.

Anti-siphon fill valves are installed in water closet flush tanks and in urinals.

### **Vacuum Breakers**

There are several different classifications of vacuum breakers - atmospheric vacuum breakers, pressure vacuum breakers, hose connection vacuum breakers and spill resistant vacuum breakers.

An atmospheric vacuum breaker (AVB) consists of an air-inlet valve to prevent the siphonage of contaminants or pollutants into the potable water system. Although simple in design, its installation must follow certain guidelines in order to properly function. An AVB must be installed 150 mm (6 inches) above the highest point of downstream usage or elevated piping. It cannot be subjected to any type of backpressure. A control valve or shutoff valves cannot be installed at the outlet

or downstream of the AVB. It cannot be installed where it will be subjected to continuous pressure or supply pressure for periods longer than twelve (12) hours.

An AVB is typically installed in irrigation systems, dishwashers, and soap dispensers.

A pressure vacuum breaker (PVB) have inlet and outlet isolation (shutoff) valves, two test cocks, a check valve force loaded closed, and an air inlet valve force loaded open downstream of the check valve. Like the AVB, a PVB has installation guidelines that must be followed to ensure the proper functioning of the device. A PVB must be installed so that it's critical installation is a minimum of twelve (12) inches above the highest point of downstream use or piping.

A spill resistant vacuum breaker (SRVB), formerly known as a back siphonage vacuum breaker, consists of one check valve force loaded closed, an air inlet force loaded open to atmosphere downstream of the check valve, two shutoff valves and two test cocks. They cannot be used in installations that are subject to any form of backpressure.

The main differences between these three types of devices is that the PVB and SRVB can be subjected to continuous pressure whereas the AVB cannot be; and the PVB is intended to be installed outside whereas the SRVB is intended to be installed indoors.

A hose connection vacuum breaker wall hydrant, freeze resistant, automatic draining type, a hose connection vacuum breaker, and a hose connection backflow preventer are all devices with hose connections installed downstream of the last control valve. A hose connection vacuum breaker and a hose connection backflow preventer are wall hydrants or sill cocks, that contain an integral vacuum breaker. A hose connection vacuum breaker is a device that can be added onto an existing wall hydrant or sill cock to provide backflow protection. These devices protect against both high and low hazards, low head back pressure and backsiphonage situations.

A hose connection vacuum breaker wall hydrant, freeze resistant, automatic draining type contains an integral check valve, an atmospheric vent valve and a means to drain water from the device to prevent damage from freezing. A hose connection backflow preventer contains an integral check valve and an atmospheric vent valve. The hose connection backflow preventer contains two independently acting check valve with an intermediate atmospheric vent between the checks. It also provides a means of draining to prevent damage from freezing. This is the only device of the three that is field testable.

### **RP's, RPF's and RPDA's**

Reduced pressure principle backflow preventer (RP) and reduced pressure principle fire protection backflow preventer (RPF) consist of two independently-acting check valve force loaded closed and separated by an intermediate chamber. The intermediate chamber has a hydraulically operated relief means for venting. The assembly also contains two shutoff valves and test cocks.

A reduced pressure detector fire protection backflow prevention assembly (RPDA) contains, in addition to all of the components of an RP, a bypass line around the second check consisting of a water meter, alarm signalling device, or both, and a second RP device.

An RP device can be used under the most severe conditions, including high health hazard applications (chemically charged fire protection systems, medical equipment, processing tanks, etc.), applications where the device is subject to both backpressure and backsiphonage conditions, and continuous pressure applications. An RPDA is primarily used in, although not limited to, high hazard fire sprinkler system applications.

### **DC's DCF's and DCDA's**

Double check backflow prevention assemblies (DC) and double check fire protection backflow prevention assemblies (DCF) consist of two independently acting check valves force loaded closed, two tightly closing shutoff (isolation) valves, and test cocks.

A double check detector fire protection backflow prevention assembly (DCDA) consists of two independently acting check valves force loaded closed, two tightly closing shutoff (isolation) valves, test cocks, and a bypass line around the second check with a water meter and/or signally device and a second DC device.

DC type devices can only be used where the potential health hazard to the potable water is low. In the event that both checks fail, unlike an RP type device, there is no external indication of failure. DC type devices are commonly used in application such as main supply lines, food cookers, and systems that contain nontoxic substances. A DCDA is primarily used in, although not limited to, low hazard fire sprinkler applications.

### **BFP's for Carbonated Beverage Dispensers**

The purpose of a backflow prevention device on a carbonated beverage machine is to prevent carbon dioxide gas and/or carbonated water from entering the copper piping of a potable water supply, resulting in a potentially danger copper poisoning situation.

A backflow preventer for carbonated beverage machines consists of two check valves and an atmospheric vent. If there is a failure of the downstream check, and the backpressure exceeds the supply pressure, the device's vent will discharge indicating to the end user that there is a failure.

A dual check valve type backflow preventer for carbonated beverage dispenses - post mix type consists of two independently acting primary check valves force loaded closed.

### **Dual Check Valve Backflow Preventer**

A dual check valve backflow preventer consists of two check valves force loaded closed. These device protect in low hazard applications which are under continuous pressure. Like its cousin for carbonated beverage dispensers, if both check valves should fail, there is no visual indication of the failure.

### **Backflow Preventer with Intermediate**

## Atmospheric Vent

The device classified as a backflow preventer with intermediate atmospheric vent contains three internal mechanical components - two check valves force loaded closed and a valve located between the check valves that is designed to automatically vent to atmosphere, thus preventing backflow into the potable water supply from with a backpressure or backsiphonage situation.

These devices can be used in low hazard applications only under continuous pressures where the outlet is subject to either low and atmospheric pressure conditions.

## Laboratory Faucet Backflow Preventers

The device classified as a laboratory faucet backflow preventer is defined as a vacuum breaker; however, unlike most vacuum breakers, it contains two check plus a means to vent to atmosphere. This device is designed specifically for installation

on a laboratory faucet downstream of the last control valve.

## In Closing

Although there are many different types of backflow preventers, each device is designed for specific installation conditions, and should be installed accordingly. The four most questions to ask yourself prior to installing a backflow preventer are:

- 1) Is the application a high hazard or low hazard?
- 2) Will the device encounter backsiphonage conditions?
- 3) Will the device encounter backpressure conditions?
- 4) Will the device be subjected to continuous or intermittent pressures?

Once you've determined the answer to these questions, you can then easily determine which type of backflow preventer best suits your application. ●

	ASSE Standard	High Hazard	Low Hazard	Backsiphonage	Backpressure	Continuous Pressure
Pipe Applied Atmospheric Type Vacuum Breakers	1001	YES	NO	YES	YES	NO
Anti-Siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks	1002	YES	NO	YES	YES	NO
Hose Connection Vacuum Breakers	1011	YES	YES	YES	LOW	NO
Backflow Preventer with Intermediate Atmospheric Vent	1012	NO	YES	YES	YES	YES
Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers	1013	YES	YES	YES	YES	YES
Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies	1015	NO	YES	YES	YES	YES
Hose Connection Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type	1019	YES	YES	YES	LOW	NO
Vacuum Breakers, Anti-Siphon, Pressure Type	1020	YES	YES	YES	NO	YES
Drain Air Gaps for Domestic Dishwasher Applications	1021	YES	YES	YES	NO	NO
Backflow Preventer for Carbonated Beverage Dispensers	1022	NO	YES	YES	NO	YES
Dual Check Valve Type Backflow Preventers	1024	NO	YES	YES	YES	YES
Dual Check Valve Type BFP for Carbonated Beverage Dispensers	1032	NO	YES	YES	YES	YES
Laboratory Faucet Vacuum Breaker	1035	YES	YES	YES	NO	NO
Reduced Pressure Detector Fire Protection Backflow Preventer Assemblies	1047	YES	YES	YES	YES	YES
Double Check Detector Fire Protection Backflow Preventer Assemblies	1048	NO	YES	YES	YES	YES
Hose Connection Backflow Preventers	1052	YES	YES	YES	LOW	NO
Spill Resistant Vacuum Breakers	1056	YES	YES	YES	NO	YES
Freeze Resistant Sanitary Yard Hydrants with Backflow Protection	1057	YES	YES	YES	LOW	NO