Principles of Backflow Prevention

Important technical and safety information for the contractor and homeowner

When the flow of water is reversed from an irrigation system back into the potable system, a backflow condition is created. If contaminants are allowed to flow back into the potable water system, even in minuscule quantities, the population is at risk of consuming fertilizers, pesticides, other toxics, soil bacteria, and animal waste.

Any connection between the potable water supply and a source of contamination is called a cross-connection. Irrigation systems might begin with potable water, but they are subject to contamination from submerged sprinklers, drip tubing in contact with the ground, auxiliary water supplies, ponds, swimming pools and other sources of non-potable water. In an irrigation system contaminants must be controlled by either an atmospheric vacuum breaker, a ***pressure vacuum breaker*** or a ***reduced pressure principle backflow prevention assembly.***

All piping from the source to the backflow preventer must be approved by local code for use with drinking water, as this pipe is part of the potable water system. In San Francisco this means copper, brass, or galvanized steel pipe.

What Causes Backflow?

Backflow is caused when an irrigation valve is open and either back-siphonage or backpressure occurs.

Conditions for back-siphonage are:

1) The irrigation system is below the valve that controls it, and

2) Water pressure at the irrigation valve falls below atmospheric pressure, which is the pressure on the water in the irrigation system.

Water pressure at the irrigation valve could drop below atmospheric pressure because of:

- Repairs or breaks in the supply line that are lower than the irrigation system.
- Lower main pressure from high water-withdrawal rates.
- Undersized main piping creates low pressure when a second, lower valve is open.
- Suction from a booster pump supplying another zone.

Solutions for back-sigphonage are ***anti-siphon valves***, ***atmospheric vacuum breakers***, or ***hose thread vacuum breakers.***

Conditions for backpressure are:

1) The irrigation system is above or below the valve that controls it

2) High pressure is introduced to a system after the valve. This occurs when superior pressure is generated in an irrigation system by an increase in elevation, a booster pump or a pressurized fertilizer injector. The solution for backpressure is a reduced pressure principle device, or ***RP***.

THE URBAN FARMER STORE

SAN FRANCISCO
2833 Vicente Street
San Francisco, CA 94116
415.661.2204

MILL VALLEY
653 East Blithedale
Mill Valley, CA 94941
415.380.3840

RICHMOND ANNEX
2121 San Joaquin St.
Richmond, CA 94804
510.524.1604

www.urbanfarmerstore.com

Types of Devices

Kinds of Atmospheric Vacuum Breakers "AVB"

RP's are allowed in all water districts, and are usually recommended by them. **Atmospheric vacuum breakers** (AVB) are designed to prevent back-siphoning and are not effective against backpressure. The device uses a disc-float assembly to seal off the atmospheric vent area when the system is pressurized. When the water supply is shutoff or if the line pressure drops to the atmospheric level, the float falls, opening the atmospheric vent, and allows air to enter the piping system, thus interrupting the possible back-siphoning action.

AVB's should be installed at least 12 inches above all downstream piping and outlets. If piping is run to a point of higher elevation, the pressure created by the elevated water will cause backpressure to keep the air-inlet valve closed, and the assembly loses its intended protection.

Never place shutoff valves or obstructions downstream from AVB's. A shut-off valve will keep the assembly under pressure and allow the float check to seal against the air-inlet port. The result is simply an elbow in the piping system and not a backflow-preventer. For that same reason, an atmospheric vacuum breaker must not be used for more than 12 hours in a 24-hour period.

Pressure Vacuum Breaker "PVB"

Pressure vacuum breakers (PVB) also are designed to prevent back-siphoning and are ineffective against backpressure. Pressure vacuum breakers use a check valve designed to close with the aid of a spring when water flow stops. The air inlet valve opens when the internal pressure is one PSI above atmospheric pressure, preventing non-potable water from being siphoned back into the potable system. The assembly includes resilient, seated shutoff valves and test-cocks.
Being spring-loaded, PVB's don't rely on gravity like AVB's, and can be installed on the pressure side of a shutoff valve. Pressure vacuum breakers must be installed at least 12 inches above all downstream piping and outlets and can be used to protect against a pollutant or contaminant. *Note that PVB's are not allowed in many water districts.*

Reduced Pressure Principle Assembly "RP"

Reduced Pressure Principle Assemblies (RP) protect against backpressure AND back-siphoning of pollutants and contaminants. The assembly is comprised of a mechanically independent and hydraulically dependent relief valve between two internally loaded, independently operating check valves. During normal operation, the pressure in the zone between the two check valves is maintained lower than the supply pressure. If the zone pressure approaches the supply pressure, the relief valve will automatically maintain a differential of not less than two PSI between the supply pressure and the zone between the two check valves by discharging to the atmosphere.
The RP also contains tightly closing, resilient-seated shutoff valves upstream and downstream of the check valves, along with resilient-seated test cocks.
General installation requirements for backflow prevention devices: (1) install in an accessible location for inspection and servicing (2) flush pipelines thoroughly prior to installing (3) install with air vents and relief valves of RP at least 12" above grade.
Other devices that prevent backflow but are not sufficiently foolproof for use with contaminants include check valves and double-check valves. The potential problem with a check valve is that it can become fouled by a piece of debris, and then water can flow back through it. There is no external sign or easy way to check whether this has happened. The same problem can occur with a double-check valve, although there are external test ports that can be used to discover the problem. When using an RP you can use angle or globe valves in underground valve boxes.

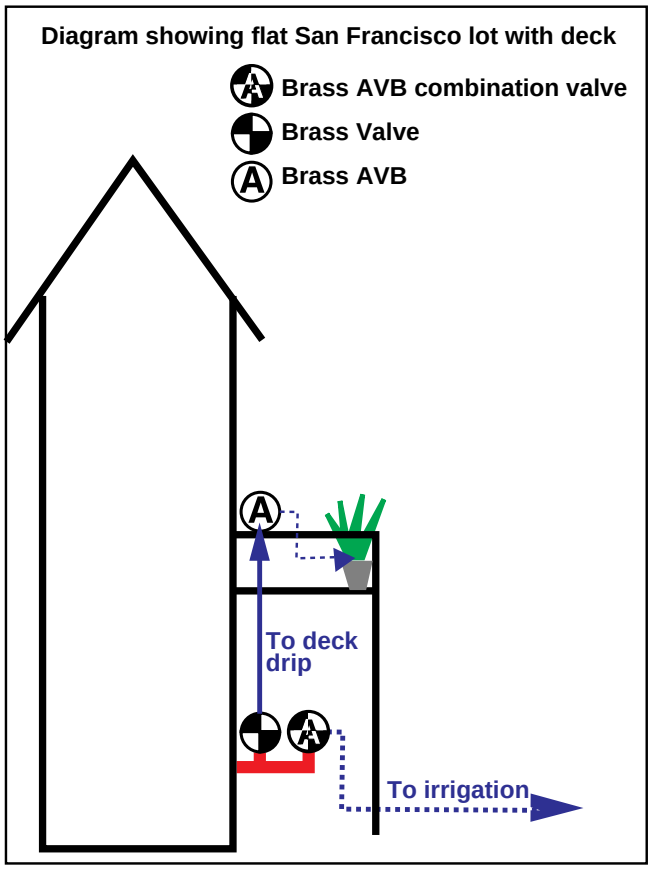
Diagram showing flat San Francisco lot with deck
Brass AVB combination valve
Brass Valve
Brass AVB
To deck drip
To irrigation

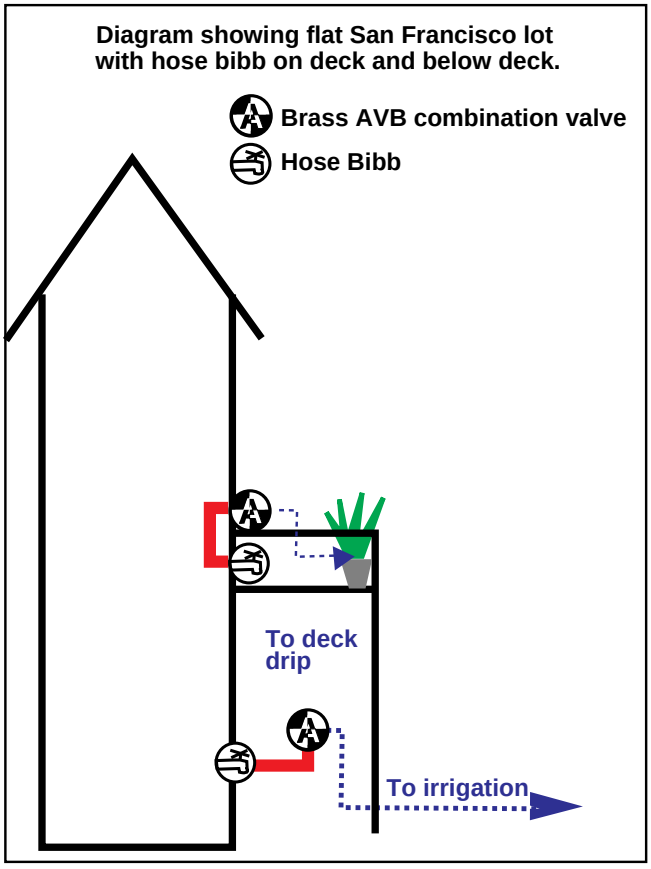
Diagram showing flat San Francisco lot with hose bibb on deck and below deck.
Brass AVB combination valve
Hose Bibb
To deck drip
To irrigation

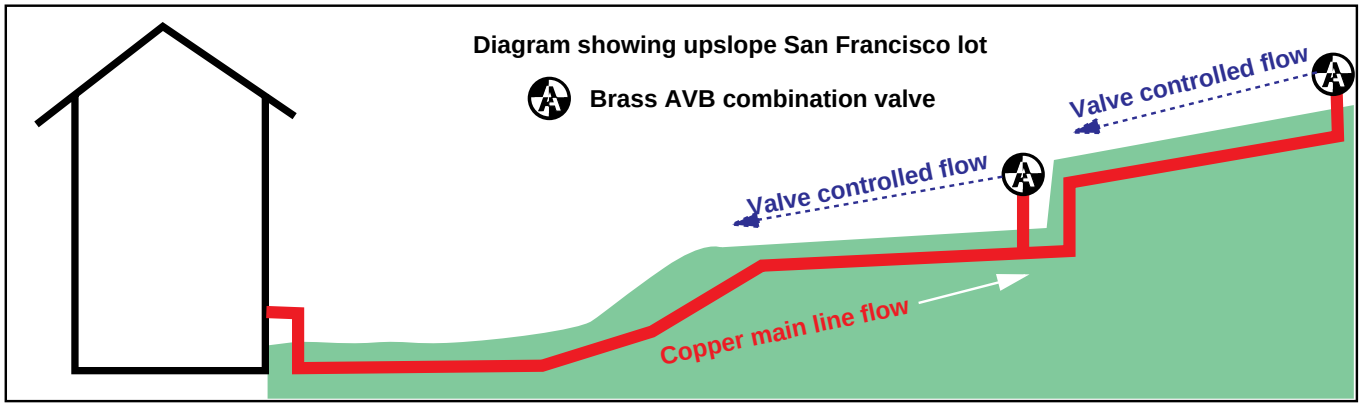
Diagram showing upslope San Francisco lot
Brass AVB combination valve
Valve controlled flow
Valve controlled flow
Copper main line flow

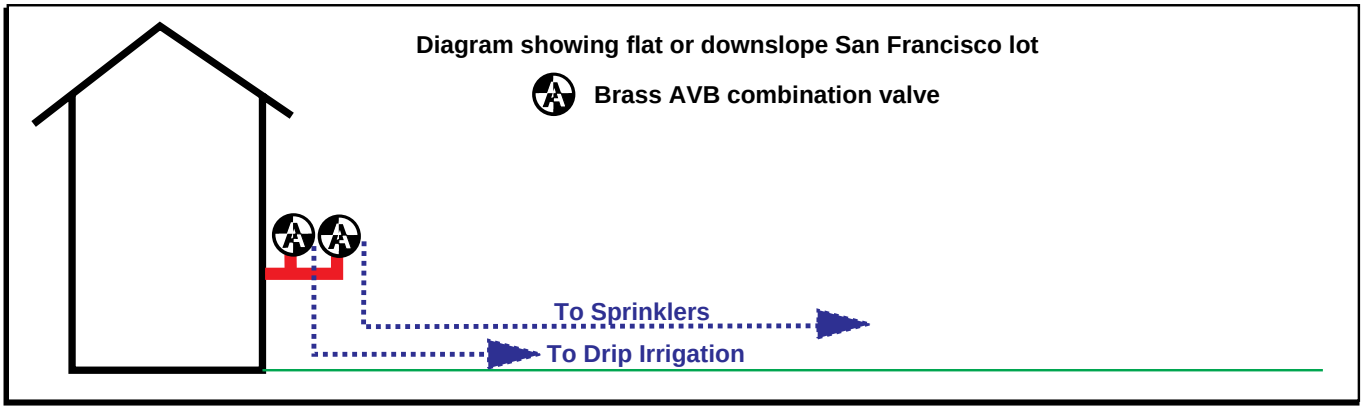
Diagram showing flat or downslope San Francisco lot
Brass AVB combination valve
To Sprinklers
To Drip Irrigation