Backflow Prevention Principles

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, soil bacteria and animal residues.

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 nonpotable 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 backsiphonage or backpressure occurs.

Conditions for backsiphonage 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.

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.

Types of Devices

Atmospheric vacuum breakers (AVBs) are designed to prevent backsiphonage 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 backsiphoning action.

AVBs 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 AVBs. 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.

Examples of AVBs are the front half of a standard anti-siphon irrigation valve, a stand-alone anti-siphon such as LL75-VBU, or a hose-thread vacuum breaker.

Pressure vacuum breakers (PVBs) also are designed to prevent backsiphonage 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. Its air inlet valve opens when the internal pressure is one psi above atmospheric pressure, preventing nonpotable water from being siphoned back into the potable system. The assembly includes resilient, seated shutoff valves and testcocks.

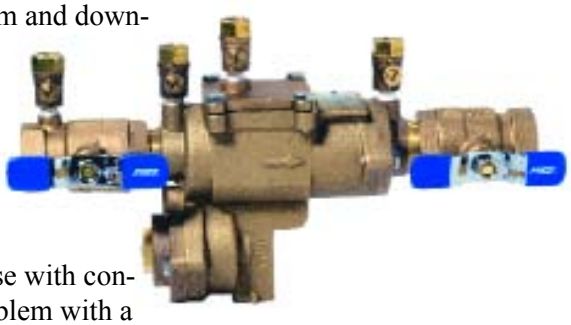
Being spring-loaded, PVBs don't rely on gravity like AVBs, and can be installed on the pressure side of a shutoff valve. Pressure vacuum breakers must be installed at least 12 inches above all downstream piping and outlets and can be used to protect against a pollutant or contaminant.

Pressure Vacuum Breaker (PVB)

Reduced Pressure Principle Assemblies (RPs) protect against backpressure AND backsiphonage of pollutants and contaminants. The assembly is comprised of two internally loaded, independently operating check valves with a mechanically independent, hydraulically dependent relief valve between.

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.



Reduced Pressure Principle Assembly (RP)

General installation requirements for backflow prevention devices:

- Install in an accessible location for inspection and servicing.
- Flush pipelines thoroughly prior to installing.
- Install air vents and relief valves 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.

Typical Layouts

Diagram showing typical flat lot with deck and container

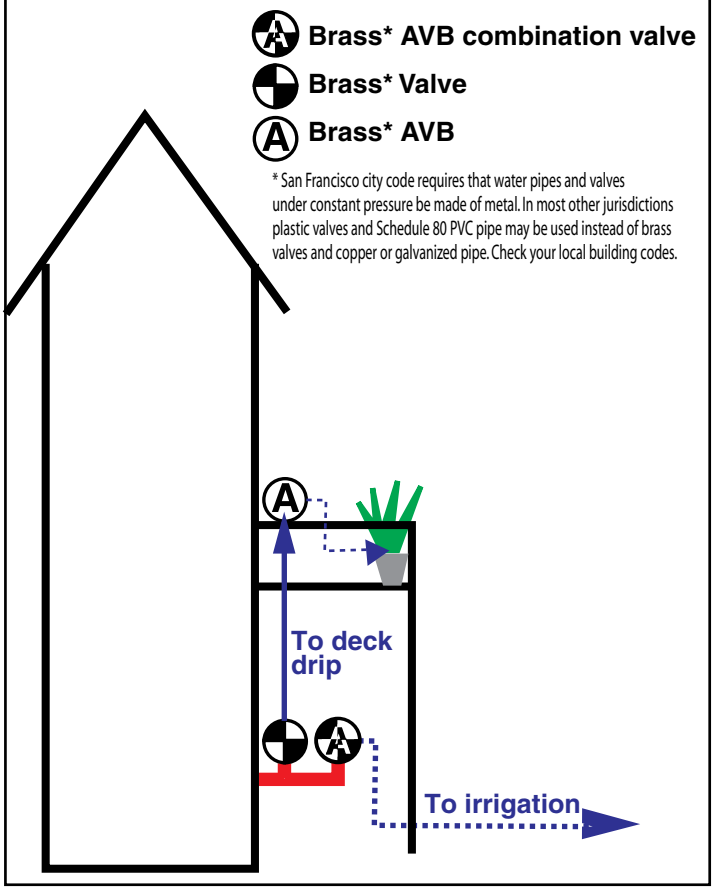
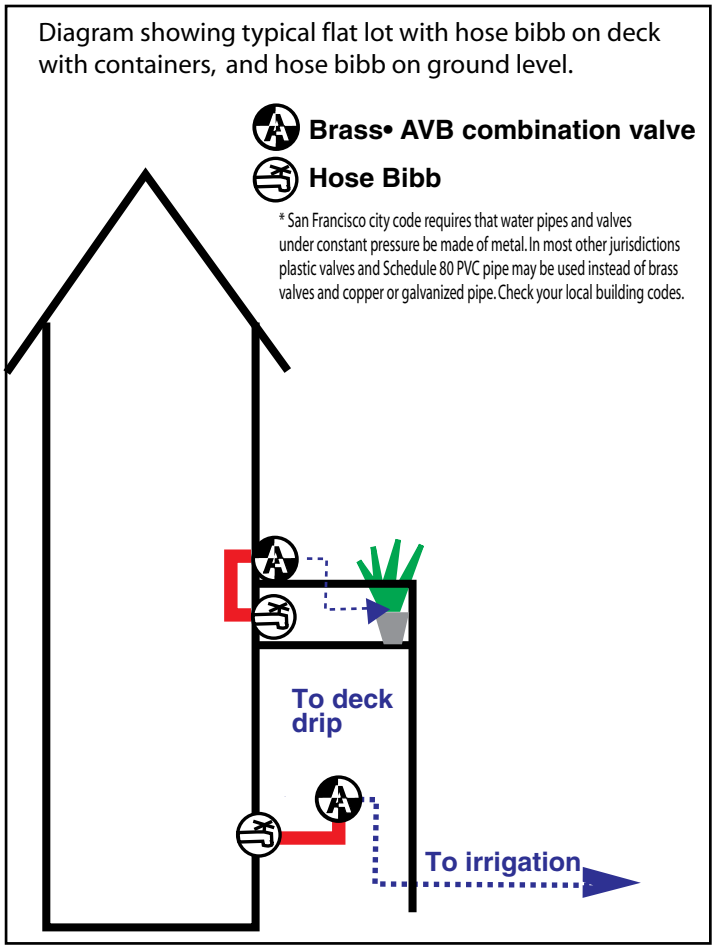
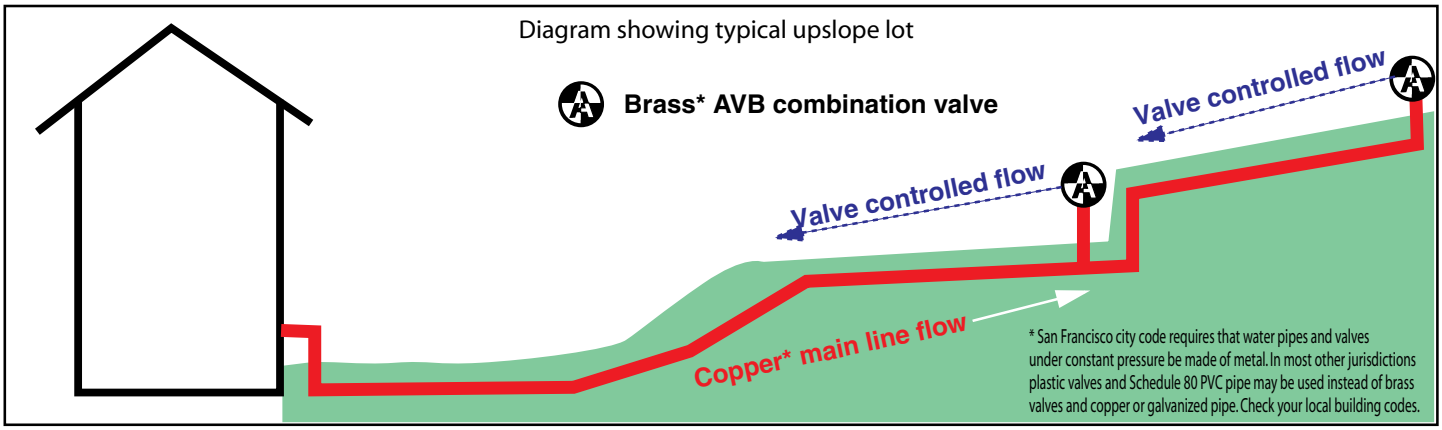
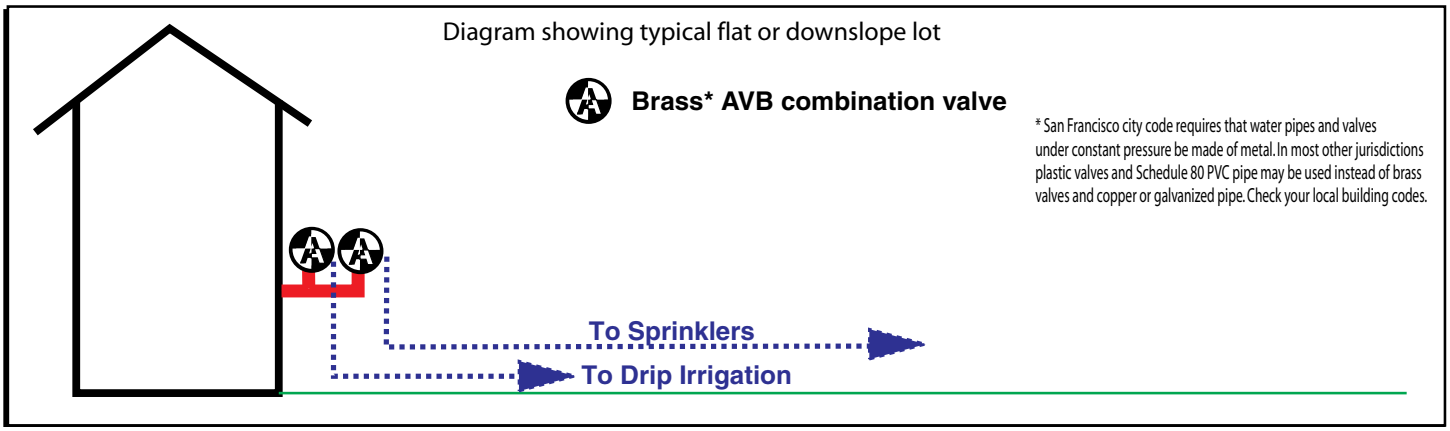


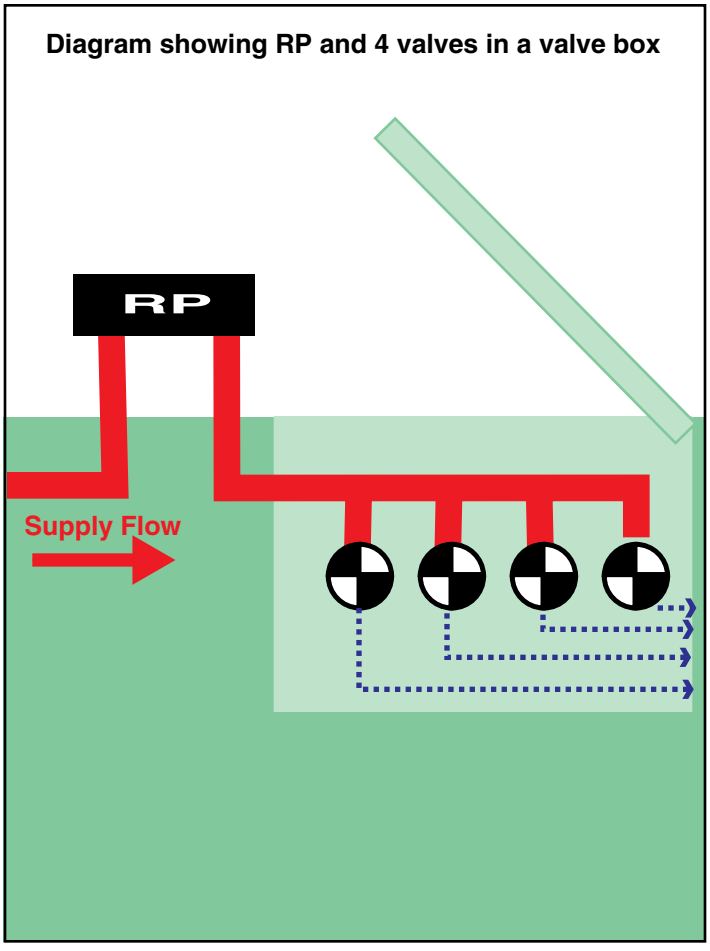
Diagram showing typical flat lot with hose bibb on deck with containers, and hose bibb on ground level.



* San Francisco city code requires that water pipes and valves under constant pressure be made of metal. In most other jurisdictions plastic valves and Schedule 80 PVC pipe can be used instead of brass valves and copper or galvanized pipe. Check your local building codes.







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