

Irrigation FACTSHEET



BRITISH
COLUMBIA

Ministry of Agriculture and Food

Order No. 578.130-1
September 1985
Agdex: 753

IRRIGATION SYSTEM CROSS CONNECTION CONTROL

A cross connection is defined as any connection or structural arrangement between a potable water system and any non-potable water, gas or chemical source through which backflow can occur. Any temporary or permanent devices through which backflow can occur are considered cross connections.

A direct connection between a potable water system and a non-potable system is subject to backflow conditions due to either backsiphonage or backpressure.

BACKSIPHONAGE

Backsiphonage is caused by low pressure or a reduced pressure in the supply piping. **The principle causes of backsiphonage are:**

- Undersized piping in the supply line. (Creates a severe hydraulic gradient along pipeline).
- Line breakage which is lower than a service point.
- Reduced mainline pressure due to a high water withdrawal rate such as fire fighting or mainline flushing.
- Reduced supply mainline pressure due to pump or power failure.

BACKPRESSURE

Backpressure occurs when the user system is at a higher pressure than the potable water supply system. **The major sources of backpressure are:**

- Booster pumps on the user system to increase flows and pressure requirements.

- Interconnection with other piping systems operating at higher pressure.
- Connections to pressurized systems such as boilers etc.

DEGREE OF HAZARD

The correct application of a backflow prevention device depends on the degree of hazard, whether backpressure or backsiphonage will occur and knowledge of the operation of various types of approved backflow prevention devices. Three degrees of hazard are considered:

Severe – An existing or probable cross connection involving any substance in sufficient concentration to cause death, spread disease or have a high probability of causing such effect.

Moderate – An existing or probable cross connection involving any substance which has a low probability of becoming a severe hazard and basically constitutes a nuisance or is aesthetically objectionable if introduced into the water supply.

Minor – An existing or probable connection between a potable water supply line and a vat or tank intended for holding potable water which has a low probability of becoming contaminated.

Irrigation systems are generally considered moderate hazards. When chemicals and fertilizers are injected into the irrigation system, the hazard is considered to be severe.

CROSS CONNECTION CONTROL DEVICES AND INSTALLATIONS

Air Gap Separation:

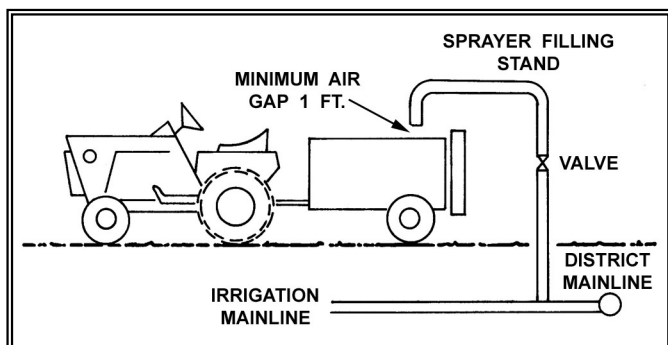
An approved air gap separation means an unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe and the flood level rim of the receptacle. The physical separation must be at least twice the diameter of the inlet pipe and never less than 2.5 cm (1 inch).

A properly maintained air gap provides the utmost protection against backflow. Air gaps are, however, vulnerable to bypass arrangements which nullify their effectiveness. Since irrigation systems are under positive pressure while operating, the air gap separation method is not possible.

Installation

An air gap separation should be maintained on all sprayer-filling lines to prevent backflow occurrences. (See Figure 1). A vacuum breaker should be utilized as an extra precaution in situations where the minimum air gap cannot be maintained.

Figure 1



Barometric Loop:

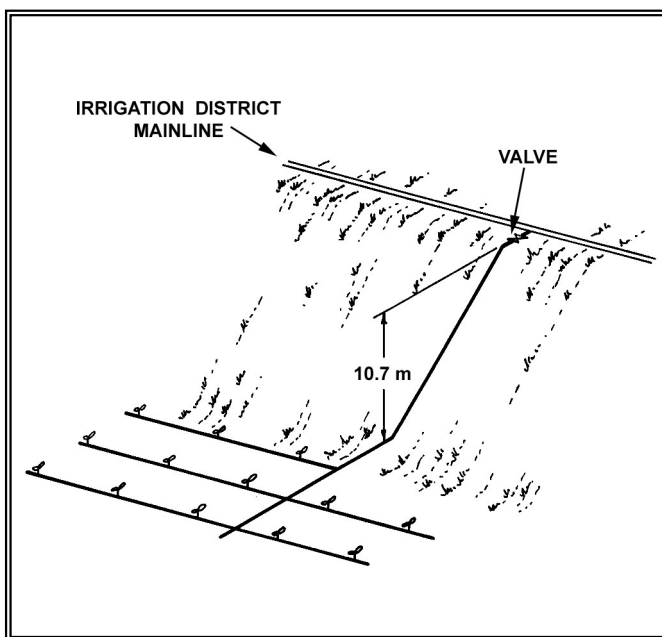
A barometric loop is a piping arrangement designed to make use of the principle that a perfect vacuum can lift water only 10.4 m (34 ft). Constructing a loop in the irrigation mainline which rises 10.7 m (35 ft) above the rest of the system will act as a barometric loop. **The barometric loop is effective against backsiphonage only.** In situations where backpressure conditions may arise, some other form of backflow prevention is required.

Installation

The barometric principle is practical only in site specific situations where:

- The irrigation system is situated at least 10.7 m below the water supply mainline. (Natural barometric loop). See Figure 2.
- The type of protection required is to prevent backsiphonage only. (A chemical injector pump or other pressure-producing device cannot be connected onto the irrigation system).

Figure 2



Atmospheric Vacuum Breaker

An atmospheric vacuum breaker (AVB) allows air to enter the downstream line when the line pressure is reduced to a gauge pressure of zero or less. The AVB must be installed downstream of the last shutoff valve and a minimum of 15.2 cm (6 inches) above the highest outlet on the non-potable system. An AVB should not be used where continuous operating pressure is applied for more than 12 hours in any 24-hour period because the relief valve may stick in the closed position and cause malfunction. See Figures 3.1 and 3.2.

Figure 3.1

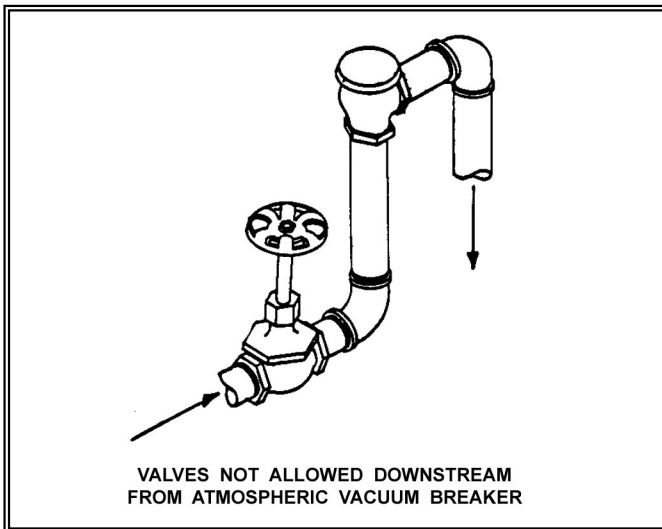


Figure 4.1

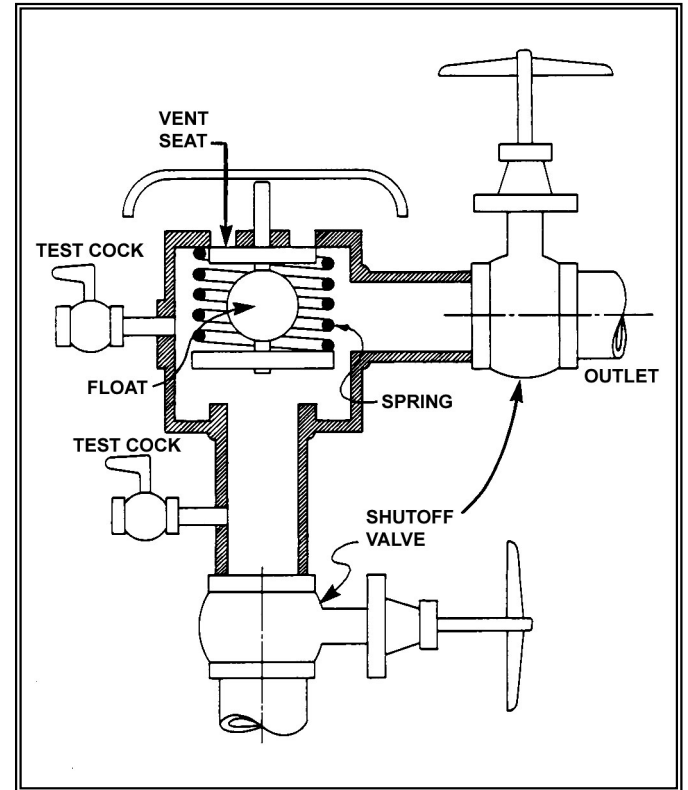


Figure 3.2

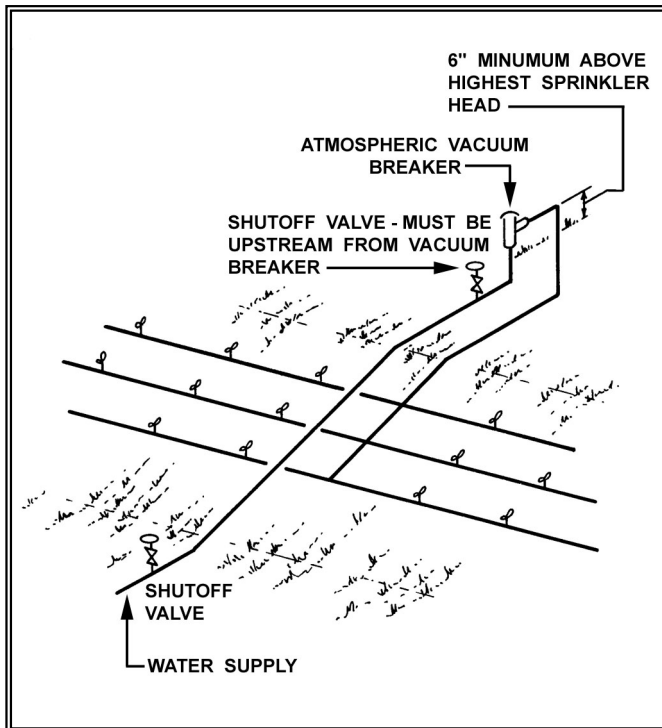
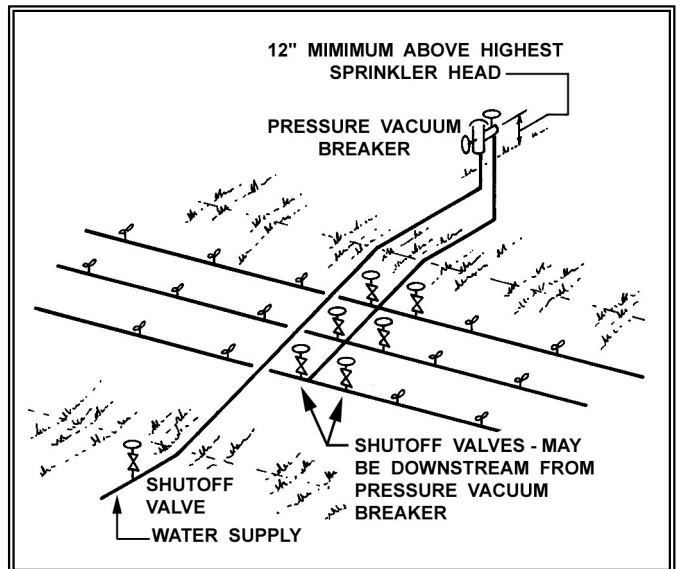


Figure 4.2



Pressure Vacuum Breaker

The pressure vacuum breaker (PVB) has an atmospheric vent valve which is internally loaded by a spring. The PVB can therefore be installed on the pressure side of a shutoff valve and used in situations that are operating under continuous pressure. A PVB should be installed 30.5 cm (12 inches) above the

highest outlet on the non-potable water system. See Figures 4.1 and 4.2.

Vacuum breakers, whether pressure or atmospheric are effective against backsiphonage only. They cannot be used in backpressure situations.

Double Check Valve Assembly

A double check valve assembly (DCVA) consists of two approved check valves, internally loaded either by a spring or weight, which are installed as a unit between two tightly closed shutoff valves. DCVA's are effective against backflow caused by backpressure or backsiphonage and are used to protect water systems from substances which are not hazardous to health.

A DCVA should be installed at the start of the irrigation distribution system. See Figures 5.1 and 5.2.

Figure 5.1

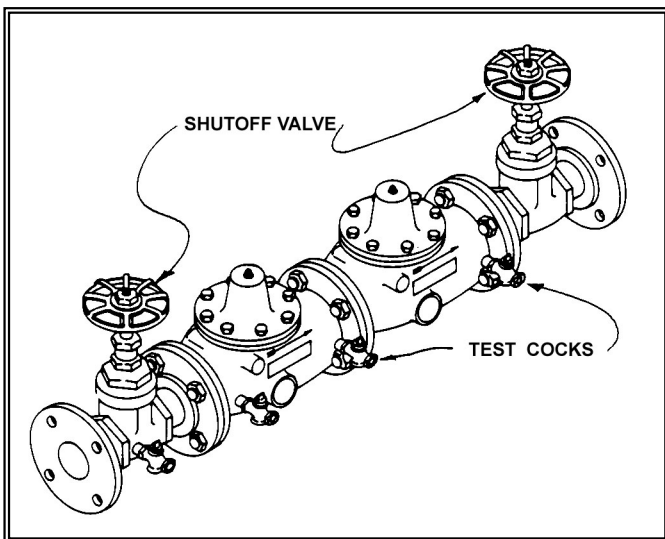
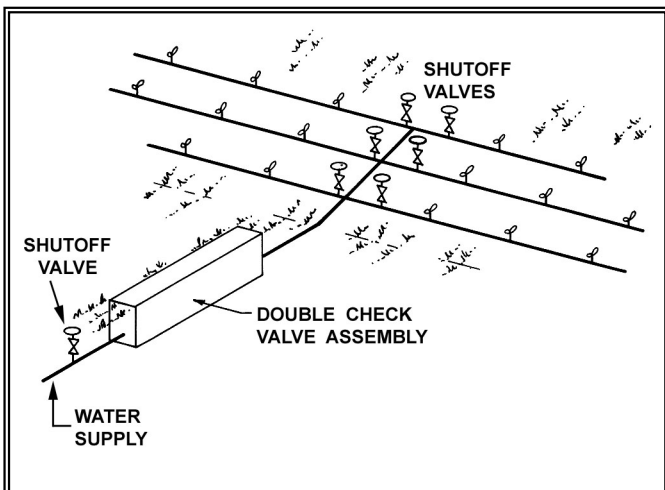


Figure 5.2



Reduced Pressure Principle Backflow Prevention Device

A reduced pressure principle backflow device (RPBD) consists of two independently acting, internally loaded check valves separated by a reduced pressure zone. The device should be installed as a unit between two tightly closing shutoff valves. During normal operation, the pressure between the two check valves is maintained at a lower pressure than the supply pressure. If either check valve should leak, a differential pressure relief valve will maintain the pressure difference between the supply pressure and lower pressure zone by discharging to the atmosphere. Inspection of the unit will therefore indicate a malfunctioning before a danger of backflow exists. See Figures 6.1 and 6.2

The RPBD is effective against backflow caused by backpressure and backsiphonage and is used to protect the water system from substances which are hazardous to health.

All mechanical backflow prevention devices should be installed to allow proper operation, inspection and servicing when required. Clearances of at least 30 cm may be required around the device to allow for removal of check valves, pressure relief valves etc.

Figure 6.1

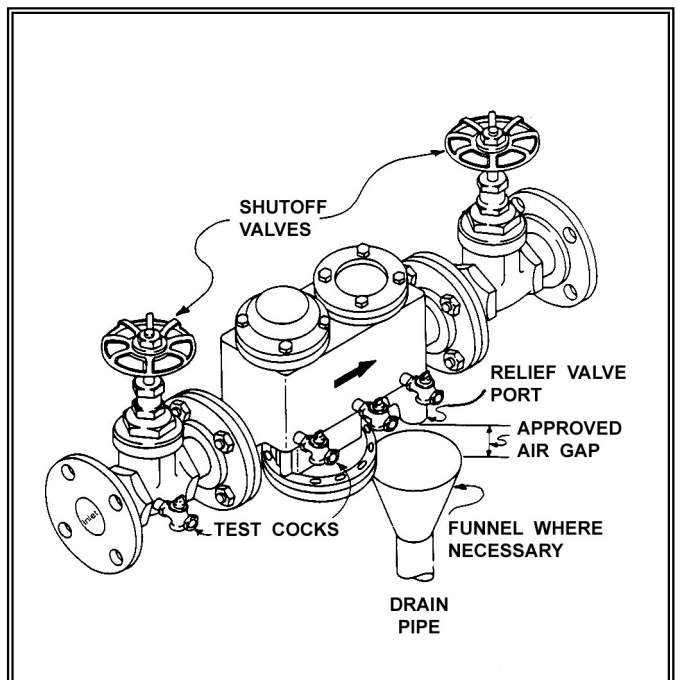
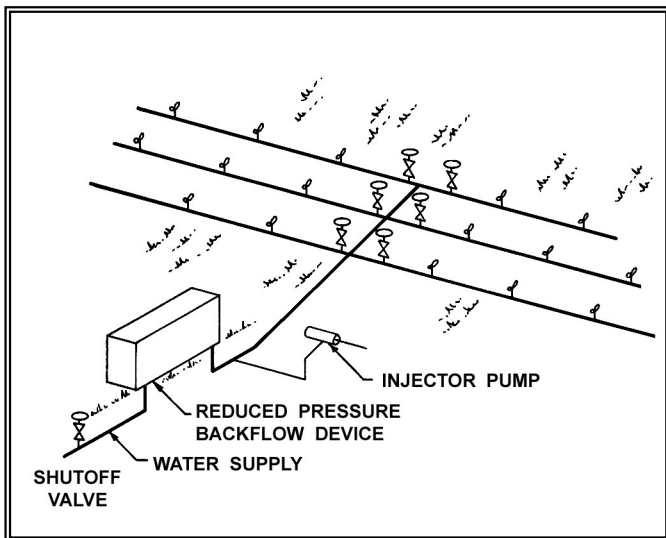


Figure 6.2



SELECTING A BACKFLOW PREVENTOR

The selection of a backflow preventor will depend upon degree of hazard, type of protection required (backpressure or backsiphonage) and unit cost.

The following summarizes the correct application of various backflow prevention principles and devices based on irrigation system conditions.

Air Gap

- Sprayer filling stations are only realistic application.

Barometric Principle

- Can only be used for irrigation systems situated at least 35 ft below the potable water supply mainline.
- The irrigation system cannot be capable of producing any backpressure. (i.e. no elevation gains, injector pumps or other pressure sources to be hooked into the irrigation distribution system.)
- Provide protection against backsiphonage only.

Atmospheric Vacuum Breaker

- Must be installed downstream of all shutoff valves.
- Must be installed at least 6 inches above the highest point of the irrigation system.
- Cannot be used on systems that are continually pressurized.
- Provide protection against backsiphonage only.
- Should only be used for situations where fertilizers and other chemicals **are not injected** into the irrigation system.

Pressure Vacuum Breaker

- Can be installed before shutoff valves.
- Can be used on continuously pressurized systems.
- Must be installed at least 12 inches above the highest point of the irrigation system.
- Provide protection against backsiphonage only.
- Should only be used on moderate hazards – chemicals and fertilizers are **not injected** into the irrigation system.

Double Check Valve Assembly

- Can be installed at the main connection of the irrigation system to the water supply mainline.
- Provide protection against backpressure and backsiphonage.
- Should be used for moderate hazard protection only.

Reduced Pressure Principle Backflow Preventor

- Can be installed at the main connection of the irrigation system to the water supply mainline.
- Provides protection against backpressure and backsiphonage.
- Indicates whether unit is malfunctioning.

Should be used for severe hazards such as:

- i) Irrigation systems injecting chemicals and fertilizers.
- ii) Sprayer filling lines where an approved air gap cannot be maintained.

REFERENCES

- ***Cross Connection Control***. British Columbia Section of American Water Works Association.
- ***M14 Recommended Practice for Backflow Prevention and Cross Connection Control***. American Water Works Association, Denver, USA.
- ***Cross Connections and Backflow Prevention 2nd Edition***. American Water Works Association.
- ***Accepted Procedure and Practice in Cross Connection Control Manual***. Cross Connection Control Committee, Pacific Northwest Section AWWA.

The British Columbia section of the American Water Works Association (AWWA) publishes a Cross Connection Control Manual. The manual provides guidelines and standards for the installation and

operation of approved backflow prevention devices in BC. It is the responsibility of municipalities and local water supply districts to ensure proper cross connection control procedures are maintained.

The purpose of this extension note is to provide persons in the irrigation industry with basic information on cross connection control. It is **not** intended to be used as a regulatory publication. Persons wishing additional information on approved cross connection control devices and installation methods must obtain a copy of the BC Cross Connection Control Manual.

Irrigation systems in BC are quite often installed in areas where cross connection control guidelines are not enforced. The table below provides the degree of hazard rating for various types of irrigation system specifications. An appropriate backflow prevention unit must be selected.

| IRRIGATION SYSTEM SPECIFICATIONS | DEGREE OF HAZARD |
|-----------------------------------|------------------|
| - Handmoves, Wheelmoves | Minor |
| - Centre pivots, Gun systems | Minor |
| - Solid set overtree undertree | Minor |
| - Trickle | Moderate |
| - Large Turf | Moderate |
| - Residential | Minor |
| Fertilizer, Chemical Injection | Severe |
| Sprayer Filling Station | Severe |

FOR FURTHER INFORMATION CONTACT:

Ted Van der Gulik, Senior Engineer
Phone: (604) 556-3112
Email: Ted.Vandergulik@gems8.gov.bc.ca

RESOURCE MANAGEMENT BRANCH

Ministry of Agriculture and Food
1767 Angus Campbell Road
Abbotsford, BC CANADA V3G 2M3