

Plumbing Code - Chapter 10

Notes:

The plumbing code chapters that address water supply and distribution offer a great deal of direction regarding the safety of the potable water supply. The code's primary focus is protecting the occupants in a building and maintaining systems in a safe, sanitary manner without the danger of backflow from cross connections.

10.1 PIPE IDENTIFICATION

The identification of piping systems is critical. Any structure containing a potable and a non-potable system, for example, must have the systems labeled. Potable water systems must have a green background with white lettering. Non-potable systems must have a yellow background with black letters including the words: "Caution: Non-potable water, do not drink." These labels must be provided every 20 feet and not less than once per room.

Listed fixtures that contain vacuum breakers can have the discharge omitted from this labeling requirement. However, each outlet on the non-potable water line that could be used for a special purpose must have a posting of: "Caution: Non-potable water, do not drink."

Many jurisdictions have constructed dual distribution systems. These include reclaimed water. Reclaim system components will be labeled using purple (Pantone 512) with black letters for the words: "Caution Reclaimed water, do not drink."

10.2 UNLAWFUL CONNECTION

No installation of a potable water system can be made where it is possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter any portion of the piping from any tank, receptor, equipment, or plumbing fixture by reason of backsiphonage, suction, or any other cause, either during normal use and operation thereof or when such tank, receptor, equipment, or plumbing fixture is flooded or subject to pressure in excess of the operating pressure in the hot or cold water piping. In short, a cross connection cannot be installed.

Realistically, it is difficult to construct a potable water system today without the possibility of creating an actual or potential cross connection. For example, consider a hose bibb. By itself, a faucet discharging water into the atmosphere is typically safe. However, when a hose is attached, the water line is extended to the discharge of the hose, which may be in an automobile radiator.

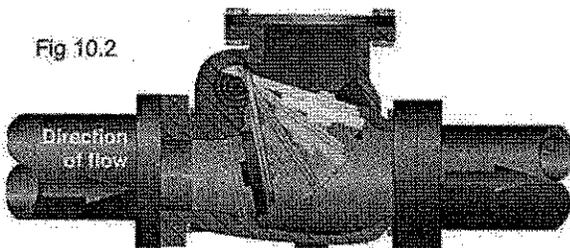


Fig 10.2

Swing-check valve (single check) is NOT a backflow preventer.

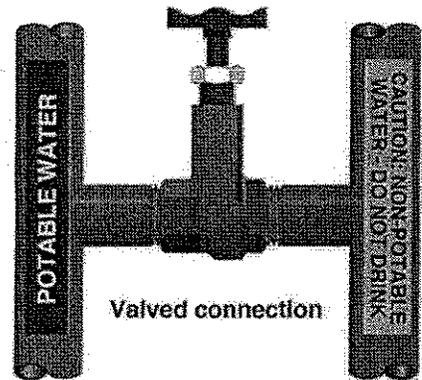


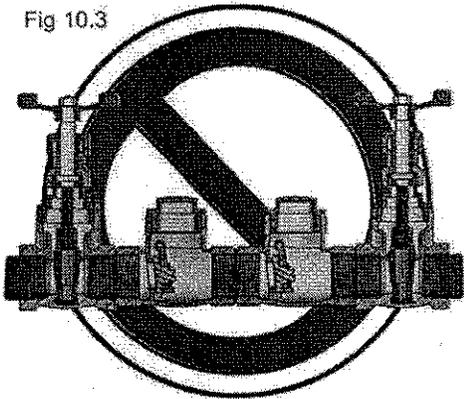
Fig 10.1

The code recognizes this potential and provides for cross-connection control. Cross connections will occur, but they must be controlled. These are controlled with mechanical backflow preventers or other means.

These backflow preventers must conform with the standards

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Notes: Fig 10.3



A homemade assembly is NOT an approved backflow preventer. Do not use two swing checks and two gate valves and believe the combined pieces make an approved double check valve assembly.

listed within the code, and they must also be acceptable to the Authority Having Jurisdiction.

10.3 TESTABLE BACKFLOW PREVENTERS:

The field-testable backflow preventers are the:

- Reduced pressure principle assembly (ASSE 1013)
- Reduced pressure detector assembly (ASSE 1047)
- Double check valve assembly (ASSE 1015)
- Double check detector assembly (ASSE 1048)
- Pressure vacuum breaker assembly (ASSE 1020)
- Spill-resistant vacuum breaker (ASSE 1056)

The national model plumbing codes, product performance standards, and manufacturers' literature require that backflow prevention assemblies be tested when installed and at least once a year thereafter. Plumbing codes require that backflow preventers be tested after a repair has been made and when an assembly has been relocated. The model

plumbing codes recognize the ASSE Series 5000 standards for tester, repairer, and survey credentials issued according to those standards.

Why should the assembly be tested after installation? After all, it's a new product and shouldn't it work from the factory?

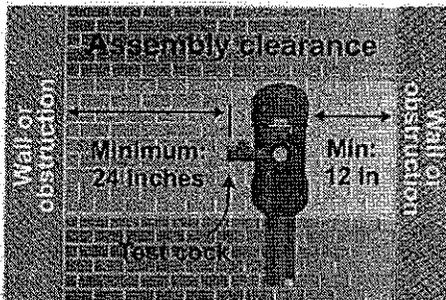
Nearly all the backflow preventer manufacturers comply with ISO 9000, which is an international quality control standard. The backflow preventer should work "out of the box." However, if the assembly is installed on a new service line, the "upstream" piping may not have been properly flushed. This may allow dirt or construction debris to enter the assembly. On existing service lines or retrofits, copper from reaming or solder may become lodged in the check valve seats. Experienced testers have reported that approximately 90 percent of backflow preventer failures are discovered at new installations.

It is the property owner's responsibility to have the assemblies tested and maintained. Again, the code-specified testing frequency is annually at a minimum.

10.4 INSTALLATION CLEARANCES

The model plumbing codes and manufacturers' installation instructions state that RPs and DCVAs need to be installed at least 12 inches (30 cm) above the surrounding ground or floor. This elevation requirement does not affect the RP or DCVA's function. The requirement exists for the technician's benefit. Adequate clearance must be provided to replace assembly components.

Fig 10.4



Some jurisdictions have additional installation requirements regarding backflow preventer side clearances. For example, it may be required that a side with a test cock have 24 inches (61 cm) clearance, and a side without a test cock should have 12 inches (30 cm) clearance.

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Historically, the justification for such requirements has been field-test convenience. Be aware that other trades may take advantage of extra space around a backflow preventer. It is common to discover electrical conduit or industrial piping invading the space of a backflow preventer after its installation.

Many would argue that a 1/2-inch assembly would not need 24 inches of clearance for testing purposes, but a 10-inch assembly may require that distance for testing and repair. As a result, some codes have adopted text that requires an assembly installation according to the manufacturer's specifications.

The installation elevation for a vacuum breaker's critical level is a limitation of the device. An atmospheric vacuum breaker and spill-resistant assembly must be installed with the critical level a minimum of 6 inches (15 cm) above the highest downstream use. A pressure type vacuum breaker must be installed with the critical level 12 inches (30 cm) above the highest downstream use. The exception to these are the deck-mounted units that must be installed 1 inch (2.5 cm) above a downstream use.

When a vacuum breaker is laboratory tested to its product standard, a vacuum pump is installed in the upstream piping of the device. A container of colored water is placed downstream of the assembly. When the vacuum is applied, a specific colored water rise in the vacuum breaker outlet piping is allowed, which must comply with the standard. If the vacuum breaker is installed too low, it is possible to siphon liquid up to and through the device. There are other specific installation requirements for vacuum breakers. Please consult the device's specific section of this manual for additional information.

10.5 HAZARD APPLICATION

The model plumbing codes are consistent regarding the application of backflow preventers for hydraulic and hazard applications. In general, field-testable backflow preventers may be used as follows: vacuum breakers (AVB/PVB/SVB) are adequate for any hazard (high or low) application but may only be used to prevent a siphon from downstream piping. In other words, vacuum breakers cannot be installed where backpressure is possible.

The RP and DCVA may be applied where either backpressure or backsiphonage backflow may occur. An RP or RPDA is considered high- or low-hazard protection, and a DCVA or DCDA provides low-hazard protection only.

An application chart is shown on the following page.

The model plumbing codes further define the use of specific backflow preventer applications.

10.6 SPECIFIC APPLICATIONS

The American Society of Sanitary Engineering publishes standards for various specific-use backflow preventers. Examples of these include:

- Hose bibb vacuum breakers (ASSE 1011 and 1019)
- Hose bibb backflow preventers (ASSE 1052)
- Laboratory faucet vacuum breakers (ASSE 1035)
- Beverage dispenser backflow preventers (ASSE 1022 and 1032)



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Notes:

Device, Assembly, or Method ¹	Degree of Hazard				Installation ^{2,3}
	Pollution (Low Hazard)		Contamination (High Hazard)		
	Back-Siphonage	Back-Pressure	Back-Siphonage	Back-Pressure	
Airgap	x		x		See Table 6-3 in this chapter.
Atmospheric Vacuum Breaker	x		x		Upright position. No valve downstream. Minimum of six (6) inches (152 mm) or listed distance above all downstream piping and flood-level rim of receptor. ^{4,5}
Spill-Resistant Pressure-Type Vacuum Breaker	x		x		Upright position. Minimum of six (6) inches (152 mm) or listed distance above all downstream piping and flood-level rim of receptor. ⁴
Double Check Valve Backflow Preventer	x	x			Horizontal, unless otherwise listed. Requires one (1) foot (305 mm) minimum clearance at bottom for maintenance. May need platform/ladder for test and repair. Does not discharge water.
Pressure Vacuum Breaker	x		x		Upright position. May have valves downstream. Minimum of twelve (12) inches (305 mm) above all downstream piping and flood-level rim of receptor. May discharge water.
Reduced Pressure Principle Backflow Preventer	x	x	x	x	Horizontal unless otherwise listed. Requires one (1) foot (305 mm) minimum clearance at bottom for maintenance. May need platform ladder for test and repair. May discharge water.

¹ See description of devices and assemblies in this chapter.

² Installation in pit or vault requires previous approval by the Authority Having Jurisdiction.

³ Refer to general and specific requirement for installation.

⁴ Not to be subjected to operating pressure for more than 12 hours in any 24-hour period.

⁵ For deck-mounted and equipment-mounted vacuum breaker, see Section 603.4.15.

The model plumbing codes also have specific-use applications for backflow preventers. Examples of these include:

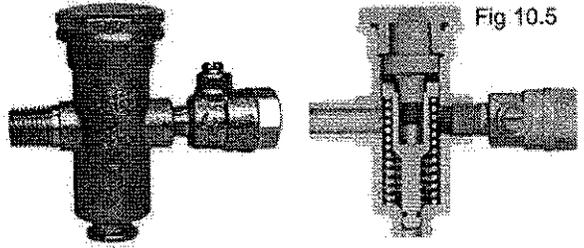
- Irrigation sprinkler systems are considered high-hazard applications. If chemicals are used in the system, such as chemigation, an RP is required, as backpressure may be present. Otherwise, a vacuum breaker may be used if it is installed correctly.
- Fire-sprinkler systems can be considered a low- or high-hazard application. If the system is constructed with potable water pipe and no chemicals are used in the system, such as antifreeze or fire retardants, no backflow preventer is required. If the system is constructed using non-potable water pipe, such as black iron and no chemicals are used, a DCVA is the minimum protection. If any chemical is used in the sprinkler system, the assembly required is an RP.



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There are a number of other special applications, such as heat exchangers, flushometers, toilet tanks with ballcocks, water-cooled compressors, and water treatment units. Your plumbing code should be consulted prior to making a determination of an appropriate backflow preventer.

The model plumbing codes require that backflow preventers be protected from freezing conditions. Typically, an enclosure will be required meeting the product specifications of ASSE's standard 1060. There are freeze-protection valves available that can



Notes:

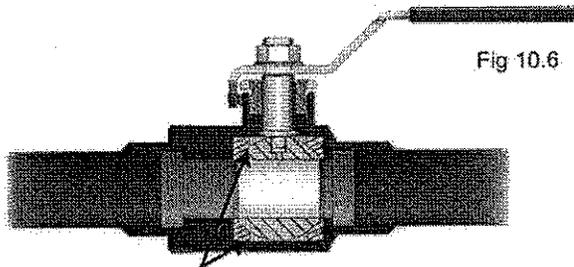


Fig 10.6

Trapped water when valve is fully opened or closed.

Test cocks are ball valves. Leave them open at 45° when winterizing.



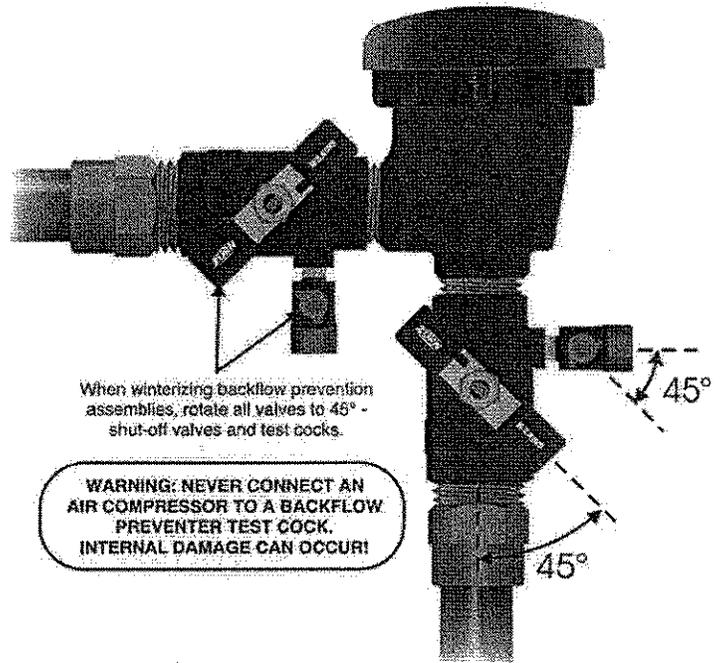
Fig 10.7

be installed as a test cock. Also, backflow preventers cannot be located in areas that contain fumes that are toxic or corrosive.

There are other backflow prevention-related provisions throughout the code. These references may involve the installation of the assembly. For example, if a backflow preventer is required as a retrofit, it will be necessary to determine the residual pressure in the system with the added device or assembly. It is important that a minimum of 15 psi (103 kPa) be maintained in the plumbing system. If the system's pressure is reduced as a result of the backflow preventer installation, the system will be out of code compliance.

The installation of a backflow preventer in a piping system creates a "closed" piping system. In other words, there is no provision for elevated pressure created by hot water to escape to the public system as a pressure sink. Therefore, the code requires the installation of thermal expansion tanks and temperature and pressure relief valves, so pressure levels will not present a danger.

If there are pressure vacuum breakers or RPs installed indoors, provisions should be made to drain any discharge. The new editions of the codes address this issue.



When winterizing backflow prevention assemblies, rotate all valves to 45° - shut-off valves and test cocks.

WARNING: NEVER CONNECT AN AIR COMPRESSOR TO A BACKFLOW PREVENTER TEST COCK. INTERNAL DAMAGE CAN OCCUR!

Fig 10.8



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Notes:

If not in the plumbing code, consider consulting the building code regarding drainage and potential structural damage.

The code is specific in stating that no potable water connection shall be made to the sanitary sewer except by an air gap. However, water supply-fed trap primers do exist through the use of an AVB. Consult the product's listing for approval and installation requirements.

Finally, water pipe sizing is critical to the proper operation of a potable water system. We have already learned that undersized piping allows for a velocity increase with a downstream demand. With the increased velocity, the system pressure will drop. One of the best methods to avoid backflow is to maintain the distribution system pressure.

10.7 DANGEROUS CONNECTIONS

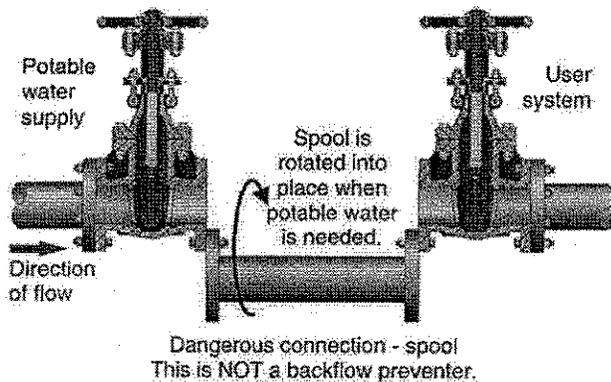
An important concept about potable water supply protection can be demonstrated with a simple lavatory. Technically, the end of the water supply is the discharge of the faucet. The beginning of the sanitary sewer is the flood-level rim of the sink. The protection is the break between the two.

Assume that a user attaches a hose to the end of the faucet to fill the sink with dye. Water discharging through a submerged hose will not cause a splash.

When shown that the hose is an extension of the water supply into the sanitary sewer, the user gets a puzzled look on their face, thinks for a moment and says, "Well, I was only going to leave it attached while I was filling the sink. Then I was going to disconnect the hose, so the water system was never in danger."

Let's keep that thought while we look at piping arrangements that can be just as dangerous, and maintained with the same argument.

Fig 10.9



10.8 SPOOL

A spool is very similar to the hose on a faucet. Here, a section of pipe is removed, creating a physical break between the potable supply and the user's application. When potable water is needed, the user installs a spool section of pipe to create the connection.

The user's argument is that the connection is only made when potable water is needed, and the piping system is monitored during its use.

Once the spool is installed, a direct cross connection is established between the potable supply and a source of unknown quality. To correct this piping arrangement, it is necessary to install a reduced pressure principle assembly prior to the spool.

10.9 SWING CONNECTION

A swing connection is a variation of the spool. The user has two sources of water. Generally, the choice is the potable supply. However, a shallow well may be used for supplement irrigation. The user disconnects the potable supply and swings the pip-

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ing section over to the well supply to irrigate. The industry refers to this arrangement as a "changeover device."

The argument for this piping arrangement is that at no time is the auxiliary supply ever directly connected to the potable supply. The swing makes a physical break between the two systems.

The argument fails when it is pointed out that the auxiliary supply water fills the pipes of the user's plumbing system. Although the connection to the auxiliary supply is broken, once the swing is reestablished to the potable supply, the user's plumbing system contains the contaminant.

To correct this piping arrangement, it is necessary to install a reduced pressure principle assembly prior to the swing connection.

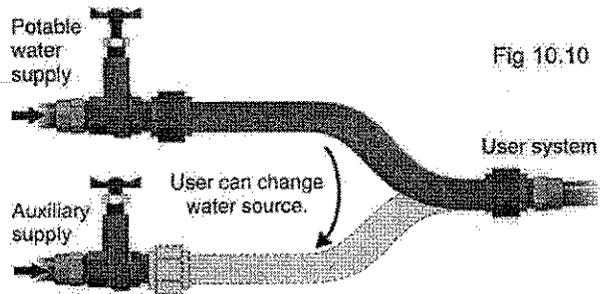


Fig 10.10

Dangerous changeover device - swing connection
This is NOT a backflow preventer.

10.10 4-WAY VALVE

While conducting a survey in a mechanical room, you note that two correctly labeled piping systems connect at one point with a valve. The pipes are labeled potable, non-potable, waste, and use. The valve is a four-way, four-port, 90-degree turn, two-position valve. This is another type of "changeover" device.

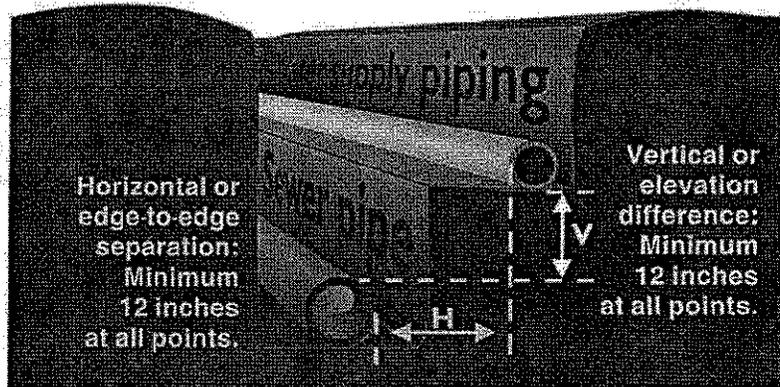
When asking for an explanation, the user replies that when clean potable water is needed, they rotate the valve handle to connect with the supply. If they need non-potable water, the valve handle is rotated to supply water from the other source. The argument again is that at no time is the non-potable supply connected to the potable supply.

However, when the potable supply is reconnected, the non-potable water is downstream in the user's system. To correct this cross connection, a reduced pressure principle assembly must be installed in the potable supply line prior to the 4-way valve.

Backflow Prevention Reference Manual - Plumbing Code Practice Quiz

Fig 10.11

The plumbing code also contains water safety provisions including pipe installation below ground, mobile homes, reclaimed water, and more.



Potable water supply protection:
Same trench installation



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Notes:

Fig 10.12

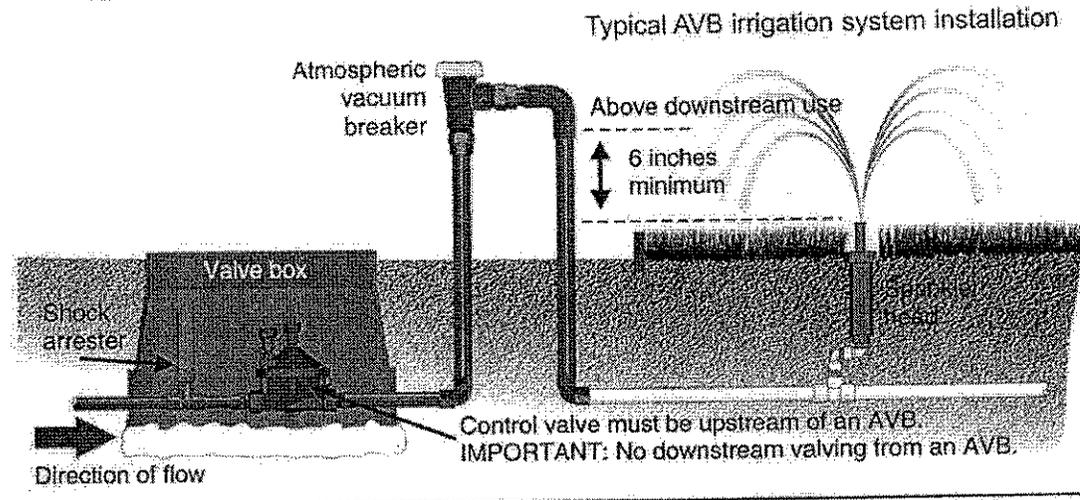


Fig 10.13

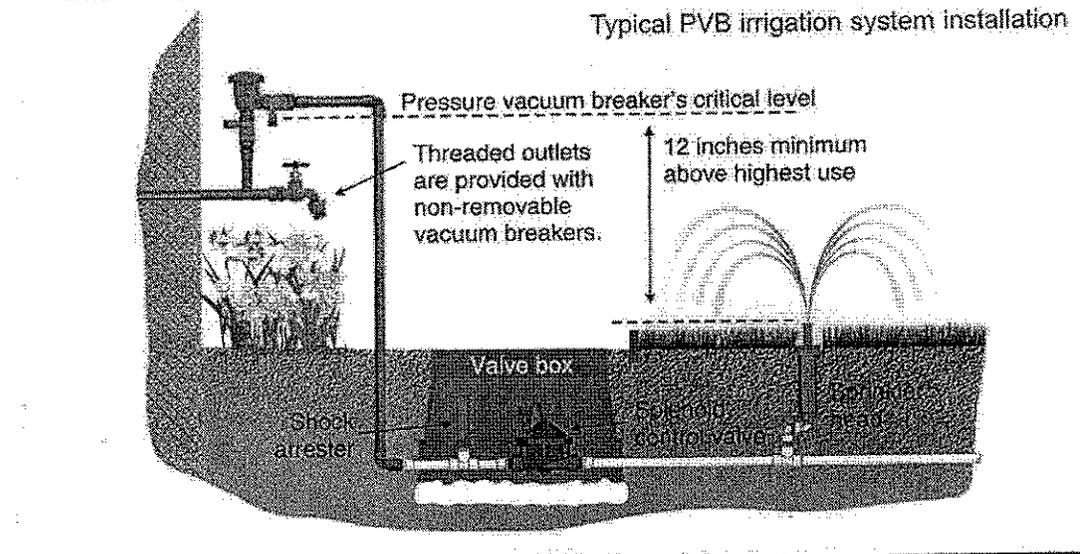
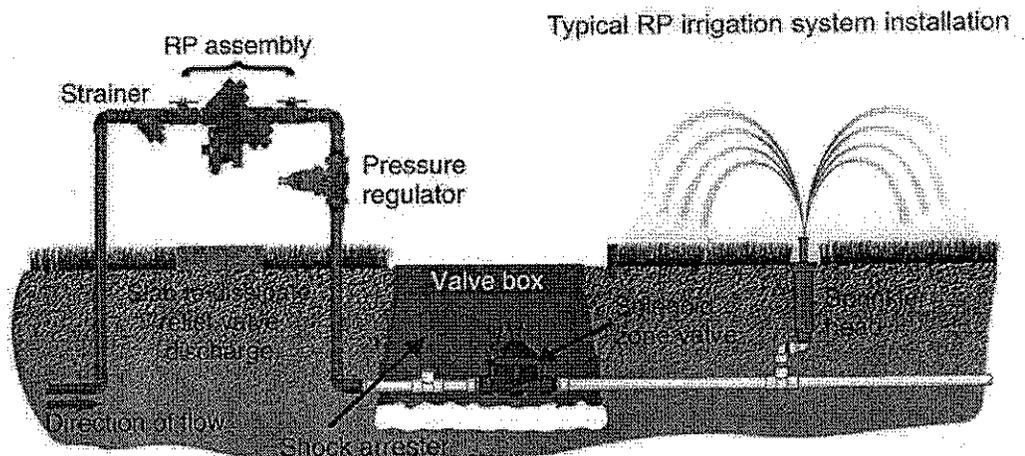


Fig 10.14



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Name: _____ Date: _____

Notes:

1. A flushometer vacuum breaker must be installed above the fixture a minimum of ____ inches.
 - a. 3
 - b. 6
 - c. 12
 - d. 18
 - e. 24
2. A heat exchanger's use of potable water must provide the protection of:
 - a. a backflow preventer
 - b. double walls
 - c. food-grade chemicals
 - d. sheathed ball cock
 - e. superior pressure
3. The Uniform Plumbing Code requires backflow preventers to be tested by a:
 - a. building owner
 - b. certified backflow assembly tester
 - c. contractor/installer
 - d. maintenance personnel
 - e. plumbing contractor
4. The critical installation level for a water closet ball cock is ____ inch(es).
 - a. 1
 - b. 2
 - c. 3
 - d. 6
 - e. 12
5. Backflow preventers may not be located in areas containing:
 - a. air-flow restrictions
 - b. inadequate lighting
 - c. low-water pressure
 - d. toxic fumes
 - e. waste discharge
6. The Uniform Plumbing Code color code for potable water pipe is:
 - a. green with yellow lettering
 - b. green with white lettering
 - c. green lettering
 - d. yellow stripes with green lettering
 - e. yellow with green lettering
7. The plumbing code requires that backflow preventers be maintained by a(n):
 - a. certified tester
 - b. contractor
 - c. inspector
 - d. owner
 - e. person having control of such device
8. Backflow preventers shall be tested when they are:
 - a. covered
 - b. frozen
 - c. heated
 - d. relocated
 - e. visible
9. Potable water connections to the inlet of a trap are protected with a(n):
 - a. atmospheric vacuum breaker
 - b. compression fitting
 - c. dual check valve
 - d. soft-seated check valve
 - e. trap primer
10. The backflow preventer not allowed on an irrigation system is a(n):
 - a. air-gap separation
 - b. atmospheric vacuum breaker
 - c. double check valve assembly
 - d. pressure type vacuum breaker
 - e. reduced pressure principle assembly