Preface

This Manual is published to provide our customers and contractors with an understanding of cross connections, backflow prevention assemblies, and the reasons for installing them. It also serves as a standard policy and a coordinated effort with local plumbing codes to ensure that our drinking water is protected from actual and potential contamination hazards.

Orange County Utilities is protecting public health through the enforcement of requirements and standards for design, construction, operation and maintenance of public potable water supply systems and reclaimed water systems. These minimum requirements are also outlined by the State of Florida Safe Drinking Water Act, Chapters 62-550, 62-555 and 62-610 of the Florida Administrative Code; Chapter 4A-46, Division of State Fire Marshall, Fire Protection Contractors and Systems; Chapter 633, Fire Prevention and Control of the Florida State Statutes (F.S.); and the Orange County Plumbing Code.

The *Orange County Utilities Cross Connection Control Program Manual* contains the details and specifications of the cross connection control program adopted by Orange County Utilities Water Division, and enforceable through Orange County Plumbing Codes.

Rules concerning reclaimed water and its use are found in Chapter 62-610 of the F.A.C. and also within Orange County’s Reclaimed Water Ordinance 94-21. Reclaimed water is defined as auxiliary water supply (see Appendix A). A residential auxiliary water supply (reclaimed water) service requires, at a minimum, that a double check valve backflow prevention (DCVA) assembly be installed on the potable water service.

Orange County Utilities Water Division and Orange County Building Division will ensure that the policies in this Manual are uniformly enforced.

If there are any questions regarding either the Manual or its policies, please call the Orange County Utilities Water Division at (407) 836-6800, between the hours of 7:00 a.m. to 4:00 p.m. If you have any questions concerning the Orange County Plumbing Code, call the Orange County Building Division at (407) 836-5506.

Copies of this Manual may be obtained from our Utilities Financial Services Division at 145 South Magnolia Avenue, Suite 100, Orlando, Florida, 32801; or by calling (407) 836-5515.
Purpose

A cross connection control program:

1. Protects Orange County Utilities potable water supply from the possibility of pollution or contamination.

2. Prohibits actual cross connections, or potential cross connections, to the water distribution system which could backflow into the public potable water supply, as required by Chapter 62-555.360 of the Florida Administrative Code (F.A.C.).

3. Controls potential cross connections and eliminates unprotected cross connections.

4. Maintains and operates a continuing program of cross connection control which will systematically and effectively aid to prevent the contamination or pollution of the potable water distribution system, as required by Chapter 62-555.360, F.A.C.

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## CROSS CONNECTION CONTROL PROGRAM MANUAL
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Backflow Principles

1.1 DEFINITION OF CROSS CONNECTION

For the purpose of this manual, the term cross connection shall mean any unprotected actual or potential connection or structural arrangement between a public or a consumer’s potable water system and any other source or system through which it is possible to introduce into any part of the potable system any used water, industrial fluid, gas or substance other than the intended potable water with which the system is supplied.

It should be noted that, under certain circumstances, atmospheric vents and relief valves on backflow preventers could allow the entry of aerosols, toxic fumes, or airborne solid particles into the system.

Bypass arrangements, jumper connections, removable sections, swivel or changeover assemblies, or any other temporary or permanent connecting arrangements through which, or because of which, backflow can or may occur, are considered to be cross connections.

1.2 CAUSES OF BACKFLOW

Wherever there is a physical connection between a potable water system and a nonpotable environment, backflow may occur from backsiphonage or backpressure. The examples, which follow, are intended to illustrate and educate about backflow prevention and cross connection control. These examples in no way represent an actual business, residence, or water system. This manual is intended to increase our understanding about the general subject.

Backsiphonage

Backsiphonage is backflow caused by negative or reduced pressure in the supply piping. Following are examples of backsiphonage:

Figure 1-1 shows how water main pressure is affected if water is withdrawn from a pipe at a very high rate. The pressure in the pipe may be reduced sufficiently to cause reversal of flow elsewhere in the system. If a connection to a contaminated source exists, backsiphonage takes place and contaminates the system. Under normal flow conditions (dotted line on graph), the distribution pressure varies from 100 psi (690 kPa) where it enters the grid to 50 psi (345 kPa) at the hydrant on the far side of the grid. NOTE: Under normal flow conditions, all premises being serviced fall below the dotted line as shown in Figure 1-1.
Figure 1-1 Backsiphonage due to high withdrawal rate of water.

For example, assume the hydrant at point F is opened and the valve at point G has been accidentally left closed. The supply of water to the hydrant during high demand (solid line on graph) has been restricted due to a closed valve at point G; therefore, when the hydrant is opened, the pressure at point F drops to zero. Now, the storage tank at point B, the top floors of the tall building at point C, the house and the swimming pool at point D, and the house at point E all fall above the high-demand line.

The pressure in the main has fallen to a point where water can no longer be supplied to those areas that fall above the high-demand line. To equalize pressure, water in the lines within these areas will flow toward the lower pressure in the supply mains. This condition has the potential for being a very serious backflow incident. The backflow condition can be further aggravated by the addition of booster pumps (either on the fire trucks or within a building’s fire system).
The backsiphonage shown in Figure 1-2 is the result of reduced water-system pressure on the suction side of an on-line booster pump. The water main pressure is only adequate to supply water to the first and second floors; therefore, a booster pump is required to service the upper floors. The potable water supply to the dishwasher on the second floor is not protected by a backflow prevention assembly and has a direct connection to the sewer.

A high demand period for the upper floors coincides with periods of low water main pressure. The booster pump supplying the upper floors creates a reduced-pressure situation in the suction line. This reduced pressure, in turn, creates a backflow condition (negative pressure situation) in the lower floor system, drawing contaminated water from the dishwasher to the suction line of the booster pump.

Figure 1-3 shows that when a distribution system is shut down to accommodate a repair, negative or reduced pressure will occur at all locations of the affected system that lay at a higher elevation than the break. As a result of the water main break in the street causing a negative pressure within the house system, contaminated water is drawn from the bathtub toward the main. More than one customer could be affected by this backsiphonage. Sometimes as many as two or three blocks of homes and commercial developments, such as coin-operated laundries, swimming pools, and so forth, are affected depending on the valve separation and elevations.

Figure 1-2  Backflow due to backsiphonage.
Backpressure

Backpressure may cause backflow to occur whenever a potable system is connected to a nonpotable supply operating under a higher pressure by means of a pump, boiler, elevation difference, air or steam pressure, and so forth. There is a high risk that nonpotable water may be forced into the potable system whenever these interconnections are not properly protected. Following are examples of backpressure circumstances:

Figure 1-4 shows how a pump on the customer’s water system can increase the pressure to a point where it exceeds the water main pressure, causing a backflow condition.

It is common practice to flush ships fire fighting systems by connecting them to dockside freshwater supplies. As shown on the graph, under normal conditions the pressure in the main is 100 psi (689.5 kPa) and approximately 75 psi (517 kPa) where it enters the ship’s system.

After completing the flushing operation, a test is conducted to determine if the fire pumps aboard ship are operating properly. As shown on the graph, the fire system pressure is boosted to 200 psi (1379 kPa). If the valve at point A is accidentally left open, the fire system pressure, which is higher than the water main pressure, forces salt water into the dockside and public supply systems.
Figure 1-4  Backflow due to backpressure.

Figure 1-5 shows a typical backflow situation where backsiphonage and backpressure act in unison as a result of a break in the water main. Assuming that all fixtures are closed, the column of water in the supply riser will fall to a level of approximately 33 ft (10 m), at sea level, to balance the atmospheric pressure on the broken water main. A vacuum has now been created in the upper levels of the supply riser. If faucet A (with attached hose submerged in a laboratory sink) was left open, the contents in the sink would be backsiphoned into the riser and distributed to other water outlets within the building after the water service was restored. It is possible the nonpotable solution that was backsiphoned into the riser could travel through the riser and service piping to the street main, where it would be transferred to the service piping of other premises.
If faucet A (with attached submerged hose) is open during a main break, the contents will be backsiphoned into the riser. With all faucets closed, water falls from top of riser to this level when the main break occurs. Water main break, water is at atmospheric pressure.

Figure 1-5  Backflow due to backpressure and backsiphonage.

If faucet B were open at the time of the water main break, some degree of backsiphonage would occur because the air flowing into the riser would experience a loss of pressure due to entrance loss (friction loss). Eventually all the water would flow to the water main.

Assume that faucets A and B were closed and check valve C between the heating system and the potable water system was leaking during the time of the water main break. The chemically treated water from the heating system would backflow into the supply riser, the water service, and the water main from the backpressure created by the circulating pump or boiler and the backsiphonage created in the supply riser by the water main break. When the water service is restored, the chemically treated heating water could be distributed through all potable water outlets connected to the supply riser and to other premises connected to the street water main.
2.1 HAZARD CLASSIFICATION

In applying the recommendations outlined in this manual, two degrees of hazards are considered and defined as follows:

Health (contaminant): a cross connection or potential cross connection involving any substance that could, if introduced into the potable water supply, cause death, illness, spread disease, or have a high probability of causing such effects.

Non-health (pollutant): A cross connection or potential cross connection involving any substance that generally would not be a health hazard, but would constitute a nuisance, or be aesthetically objectionable, if introduced into the domestic water supply.

In assessing a potential cross connection, the probability must be considered that piping may be changed, equipment may be used incorrectly, or negligence on the part of the customer may result in a backflow condition. Therefore, a potential cross connection exists if one or more of the following elements are present: bypass arrangements, jumper connections, removable sections, swivel or changeover assemblies, hoses and hose bibbs, or the presence of an abundance of piping that cannot be easily traced.

The degree of hazard increases as a function of both the probability that backflow will occur and the toxicity of the substance that may backflow. However, the risk associated with the substance’s toxicity (or virulence) is always a greater concern than the probability of backflow. When selecting the type of backflow prevention assembly, the health hazard should govern the final choice.

The correct selection of a backflow prevention assembly requires a thorough knowledge of the assembly’s operating function, the limitations of the assembly, the cause of backflow, and a correct assessment of the degree of hazard. Because of the subjective nature in determining the proper backflow prevention assembly, a guide has been developed from past experiences. This guide has been divided into Table 2-1 and Table 2-2 as follows:
Table 2-1 Guides to the Assessment of Hazard and Selection of Backflow Prevention Assemblies for Internal Protection

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<tr>
<td>Lab Bench Equipment</td>
<td>Health</td>
<td>AVB or PVB</td>
</tr>
<tr>
<td>Autopsy and mortuary equipment</td>
<td>Health</td>
<td>AVB or PVB</td>
</tr>
<tr>
<td>Sewage pump</td>
<td>Health</td>
<td>AG, RPBA</td>
</tr>
<tr>
<td>Sewage ejectors</td>
<td>Health</td>
<td>AG, RPBA</td>
</tr>
<tr>
<td>Firefighting System</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>(toxic liquid foam concentrates)</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Connection to sewer pipe</td>
<td>Health</td>
<td>AG</td>
</tr>
<tr>
<td>Connection to plating tanks</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Irrigation systems with chemical additives or agents</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Connection to saltwater cooling system</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Tank vats or other vessels containing toxic substances</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Connection to industrial fluid systems</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Dye vats or machines</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Cooling towers with chemical additives</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Trap primer</td>
<td>Health</td>
<td>AG</td>
</tr>
<tr>
<td>Steam generators</td>
<td>Non-health*</td>
<td>RPBA</td>
</tr>
<tr>
<td>Heating equipment</td>
<td></td>
<td>DCVA</td>
</tr>
<tr>
<td>Commercial</td>
<td>Non-health*</td>
<td>RPBA</td>
</tr>
<tr>
<td>Domestic</td>
<td>Non-health*</td>
<td>DCVA</td>
</tr>
<tr>
<td>Irrigation systems</td>
<td>Non-health*</td>
<td>DCVA, AVB, or PVB</td>
</tr>
<tr>
<td>Swimming pools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>Non-health*</td>
<td>RPBA or AG</td>
</tr>
<tr>
<td>Private</td>
<td>Non-health*</td>
<td>PVB or AG</td>
</tr>
<tr>
<td>Vending machines</td>
<td>Non-health*</td>
<td>RPBA or PVB</td>
</tr>
<tr>
<td>Ornamental fountains</td>
<td>Non-health*</td>
<td>DCVA, AVB or PVB</td>
</tr>
<tr>
<td>Degreasing equipment</td>
<td>Non-health*</td>
<td>DCVA</td>
</tr>
<tr>
<td>Lab bench equipment</td>
<td>Non-health*</td>
<td>AVB or PVB</td>
</tr>
<tr>
<td>Hose bibbs</td>
<td>Non-health*</td>
<td>AVB or HCVB</td>
</tr>
<tr>
<td>Trap primers</td>
<td>Non-health*</td>
<td>AG</td>
</tr>
<tr>
<td>Flexible shower heads</td>
<td>Non-health*</td>
<td>AVB or PVB</td>
</tr>
<tr>
<td>Steam Tables</td>
<td>Non-health*</td>
<td>AVB</td>
</tr>
<tr>
<td>Washing equipment</td>
<td>Non-health*</td>
<td>AVB</td>
</tr>
<tr>
<td>Shampoo basins</td>
<td>Non-health*</td>
<td>AVB</td>
</tr>
<tr>
<td>Kitchen equipment</td>
<td>Non-health*</td>
<td>AVB</td>
</tr>
<tr>
<td>Aspirators</td>
<td>Non-health*</td>
<td>AVB</td>
</tr>
<tr>
<td>Domestic space-heating boiler</td>
<td>Non-health*</td>
<td>RPBA</td>
</tr>
</tbody>
</table>

Note: AG = air gap; AVB = atmospheric vacuum breaker; DCVA = double check valve assembly; PVB = pressure vacuum breaker; RPBA = reduced pressure principle backflow prevention assembly.

* AVBs and PVBs may be used to isolate health hazards under certain conditions, that is, backsiphonage situations. Additional area or premises isolation may be required.

* Where a greater hazard exists (due to toxicity or other potential health impact) additional area protection with RPBAs is required.
Table 2-2 Guides to the Assessment of Hazard and Selection of Backflow Prevention Assemblies for Premises or Commercial Containment

<table>
<thead>
<tr>
<th>Description of Premises</th>
<th>Assessment of Hazard</th>
<th>Recommended Assembly on Water Service Pipe</th>
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<td>Hospitals, mortuaries, clinic, laboratories</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Plants using radioactive material</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Petroleum processing or storage facilities</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Premises where inspection is restricted</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Sewage treatment plant</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Sewage lift stations</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Commercial laundry</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Plating or chemical plants</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Docks or dockside facilities</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Food and beverage processing plants</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Pleasure-boat marina</td>
<td>Health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Tall buildings (protection against excessive head of water)</td>
<td>Non-health</td>
<td>DCVA</td>
</tr>
<tr>
<td>Steam plants</td>
<td>Non-health</td>
<td>RPBA</td>
</tr>
<tr>
<td>Reclaimed water systems</td>
<td>Non-health</td>
<td>DCVA</td>
</tr>
<tr>
<td>Hydrant meter connection</td>
<td>Health</td>
<td>RPBA</td>
</tr>
</tbody>
</table>

Note: AG = air gap; AVB = atmospheric vacuum breaker; DCVA = double check valve backflow prevention assembly; PVB = pressure vacuum breaker; RPBA = reduced-pressure principle backflow prevention assembly.

With potential contamination, it may be necessary to install backflow prevention assemblies on the water service pipe to contain the entire premises.

Several kinds of premises that fall into the classification of health hazards should be considered for premises containment from the purveyors water system and are noted on the following list:

- Premises with an auxiliary water supply either interconnected or not interconnected with the potable supply;
- Premises where inspection is restricted;
- Hospitals, mortuaries, clinics, and so forth;
- Laboratories;
- Piers, docks, and other waterfront facilities;
- Sewage treatment plants and sewage lift stations;
- Food and beverage processing plants;
- Chemical plants using a water process;
- Metal plating plants;
- Petroleum processing or storage plants;
- Radioactive material processing plants or nuclear reactors;
- Car washing facilities; and
- Premises with reclaimed water systems.
2.2 METHODS OF BACKFLOW CONTROL

Backflow, whether caused by backpressure or backsiphonage, is controlled by eliminating the cross connection and installing an air gap or a backflow prevention assembly.

Currently, there are several general methods or types of assemblies that are used for the prevention of backflow. They include the following:

- Air gap (AG);
- Reduced-pressure principle backflow prevention assembly (RPBA);
- Double check valve assembly (DCVA);
- Pressure vacuum breaker (PVB);
- Atmospheric vacuum breaker (AVB).

If it is necessary to maintain an uninterrupted water supply, then installing parallel backflow prevention assemblies shall be required for testing the assembly.

When backflow prevention assemblies are installed on a water supply to any premises having water heating units or boilers, a closed internal system may be created. This water system arrangement (closed internal water system) may experience thermal expansion and pressure increases.

It is the customer's responsibility to install a thermal expansion valve or a calibrated pressure relief valve at the heating source and ensure the T and P valve (temperature and pressure relief valve) are installed and working correctly according to the local plumbing code.

Air Gap (AG)

**Description (AG).** An approved air gap is the unobstructed vertical distance through free atmosphere between the lowest point of a water supply outlet and the flood level rim of the fixture or assembly into which the outlet discharges. These vertical, physical separations must be at least twice the diameter of the water supply outlet, but never less than 1 in. (25 mm). **APPROVED STANDARDS (Air-Gap):** shall conform to ANSI/ASME standard A112.1.2-1991. Ref. 62-555.360 (6) F.A.C.

In theory, a well-designed and properly maintained air gap is the best means available for protection against backflow. An approved air gap is not always practical and is vulnerable to bypass arrangements, which nullify its effectiveness. In extremely hazardous installations, an approved air gap separation is recommended. In addition, a reduced pressure assembly may be required on the supply line. Figures 2-1 and 2-2 are two uses of an air gap. Bypasses could easily nullify both of these air gaps. Such an assembly must be constructed in such a way that it is difficult to connect a hose to the supply pipe.
Air gaps are included in the annual testing and inspection program for backflow assemblies to make sure that infractions do not occur.

**Application (AG).** The only absolute means to eliminate backflow is through the use of an approved air gap as shown in Figures 2-1, 2-2, 2-3 and 2-4.

Although an air gap is considered the maximum protection available, it does not guarantee continuous protection because the air gap can be bypassed. The application of an air gap, rather than a reduced pressure principle backflow prevention assembly, depends on the requirements of Orange County Utilities Department and on the assessment of the probability of the air gap being bypassed.

**CAUTION:** The air gap represents the easiest method or situation subject to modification to a cross connection.

Figure 2-1 Air gap on tank.

![Figure 2-1 Air gap on tank](image1)

Figure 2-2 Air gap on lavatory.

![Figure 2-2 Air gap on lavatory](image2)
Every tank that is not under pressure shall be provided with an overflow pipe that will prevent flooding when all inlets to the tank are open, and all outlets, except the overflow, are closed.

Figure 2-3 Typical air gap applications.

Figure 2-4 Additional typical air-gap application.
Reduced Pressure Backflow Prevention Assembly (RPBA)

**Description (RPBA).** The approved reduced pressure principle backflow prevention assembly consists of two independently acting, approved check valves together with a hydraulically operating, mechanically independent pressure differential relief valve located between the check valves and below the first check valve. These units are located between two tightly closing resilient-seated shutoff valves, as an assembly, and are equipped with properly located resilient-seated test cocks as shown in Figure 2-5. **Approved Standards (RPBA):** shall conform to AWWA standards C511-92 or ASSE standards 1013 or USC FCCC & HR.

Figure 2-5 Reduced pressure principle backflow prevention assemblies.

![Reduced Pressure Backflow Prevention Assembly](image)

**Function (RPBA).** During normal operation, the first internally loaded check valve creates a reduced pressure zone between the two check valves and under flow conditions both check valves open, allowing water to flow to the downstream piping (Figure 2-6). The relief valve is held closed by the supply pressure acting on a diaphragm within the relief valve.

In a no-flow or static-pressure condition both check valves will close and the supply pressure will hold the relief valve shut.

![Function of Reduced Pressure Backflow Prevention Assembly](image)

Figure 2-6 both check valves open and the differential relief valve closed.
If the supply pressure drops, the relief valve will maintain a minimum pressure in the zone between check valve 1 and check valve 2 of 2 psi (13.8 kPa) lower than the supply pressure, by releasing sufficient water to maintain the required difference in pressure. If the supply pressure becomes less than 2 psi (13.8 kPa), the relief valve opens, discharging the material in the reduced pressure zone to the atmosphere (Figure 2-7).

Figure 2-7 both check valves closed and the differential relief valve open.

In the event that pressure increases downstream of the assembly, tending to reverse the direction of flow, both check valves in the assembly should close tightly and prevent backflow (Figure 2-8). However, if the second check valve does not close tightly, leakage into the reduced pressure zone will increase the pressure, which will cause the relief valve to open.

Figure 2-8 Backpressure: both check valves and the differential relief valve closed.

If the supply pressure drops to atmospheric pressure or within 2 psi (13.8 kPa) of the reduced pressure zone, the relief valve opens creating an internal air gap. Any leakage past the second check valve would then be discharged through the open relief valve (Figure 2-9).
Figure 2-9 Negative supply pressures: both check valves closed and differential relief valve open.

**Application (RPBA).** The RPBA is effective against backflow caused by backpressure and backsiphonage. (See Figure 2-10.)

Figure 2-10 Typical reduced pressure principle backflow prevention applications

Refer to Appendix C for Explanation of symbols.
The RPBA is used to isolate health hazards. The main advantage is that there is visible flow if failure of the assembly or system occurs.

The RPBA is normally used in locations where an approved air gap is impractical. It is important to remember that RPBA’s are mechanical assemblies and must be tested and serviced regularly to maintain positive protection.

**Installation (RPBA).** The following are several design installation specifications. For more information, refer to the manufacturer’s recommendations.

- The RPBA shall be installed with adequate space to facilitate maintenance and testing. Ideally, the installation should not require platforms, ladders, or lifts for access.
- Adequate clearance from the floor, ceiling, and walls must be provided to facilitate the removal of the relief valve and/or check valves.
- Refer to the manufacturer’s literature for temperature ranges. An RPBA must be protected from freezing temperatures and if installed where temperatures will reach 110 °F (43 °C) or above, the hot-water type of assembly must be used. Consult manufacturer’s specifications for recommendations.
- An RPBA shall not be installed in a pit below ground level.
- If the relief valve port is submerged in groundwater, a cross connection is created that may be more serious than the hazard that the assembly isolates.
- The daylight drain from aboveground or semi-buried vaults must provide:
  1. Adequate drainage for the discharge from the reduced pressure principle assembly relief valve port. Minimum RPBA relief valve flow rates and minimum diameter of relief valve porting are set forth in AWWA Standard C511 or the *Manual of Cross Connection Control*.
  2. Access for maintenance and periodic testing.
- Before installing an RPBA, ensure that the relief valves on the heating vessels are in good working condition. If the relief valves are not functioning properly, pressure may buildup, which may result in explosion or escape of hot liquid under pressure.
- The assembly should be sized hydraulically, taking into account both the volume requirements of the service and the head loss of the assembly. The head loss of the assembly is not necessarily directly proportional to flow. (Refer to the manufacturer’s head loss pressure curves.)
- A strainer is not considered to be part of an approved backflow prevention assembly. Therefore, if one is required, the additional head loss of the strainer must be taken into account. No strainer is to be used in a fire line without the approval of the insurance underwriters or the authority having jurisdiction. It is important to note that where strainers are required they require frequent cleaning and inspection to ensure against fouling and deterioration of the mesh.
• Reduced pressure principle assemblies shall be installed in the horizontal position.
• Flush the lines before installing the RPBA.
• The RPBA shall not be installed in an area where corrosive fumes or gases could render the assembly inoperable. The RPBA shall be installed “in line” and should be the same size as the supply and discharge piping.
• Device shall be supported to prevent sagging.

Where test cocks are threaded, these test cocks shall be plugged and not used for any other purpose except testing, as is the intent of the manufacturer.

**Double Check Valve Assembly (DCVA)**

**Description (DCVA).** This approved assembly consists of two internally loaded check valves, either spring-loaded or internally weighted, installed as a unit between two tightly closing resilient-seated shutoff valves as an assembly, and fittings with properly located resilient-seated test cocks as shown in Figure 2-11. **Approved Standards (DCVA):** shall conform to AWWA standards C510-92 or standards of USC FCCC & HR and ASSE standard 1015.

**Approved Standards (DCDA):** Double Check Detector Assembly (DCDA): shall meet ASSE standards 1048 or standards of USC FCCC & HR. A DCDA shall be used on dedicated fire lines, supplying water exclusively for fire protection systems without metering.

Figure 2-11 Double check valve assembly.

Function (DCVA). During normal operation the check valves open, permitting flow as shown in Figure 2-12.
Figure 2-12 Check valves open, permitting flow.

If backflow conditions occur, the checks will close tightly, preventing any pollution of the supply. See Figures 2-13 and 2-14.

Figure 2-13 Negative supply pressure: check valves closed.

Figure 2-14 Backpressure: both check valves closed.

**Application (DCVA).** The DCVA is effective against backflow caused by backpressure and backsiphonage and is used to protect the water system from pollutants that would not constitute an actual health hazard, but that might be objectionable to the water supply system.

The DCVA is used to isolate non-health hazards (see Figure 2-15).
Figure 2-15 Typical double check valve backflow prevention assembly applications.

**Installation (DCVA).** The following are design installation specifications. For more information, refer to the manufacturer’s recommendations and the latest approved Orange County Plumbing Code.

- The DCVA should be installed with adequate space to facilitate maintenance and testing and should have free access without the use of platforms, ladders, or lifts.
- The assembly should be sized hydraulically, taking into account both the flow rate requirements of the service and the head loss of the assembly. The head loss of the assembly is not necessarily directly proportional to flow. (Refer to the manufacturer’s head loss pressure curves.)
- A DCVA shall be installed above ground level unless provided with adequate drainage to maintain a dry location.

Refer to appendix C for explanation of symbols.
• A strainer may be required ahead of the assembly. A strainer is not considered to be part of an approved backflow prevention assembly. Therefore, if one is required, due to local conditions, the additional head loss must be taken into account. No strainer is to be used in a fire line without the approval of the insurance underwriters. It is important to note that where strainers are required they require frequent cleaning and inspection to ensure against fouling and deterioration of the mesh. Where the test cocks are threaded, these test cocks shall be plugged and not used for any other purpose except for testing, as is the intent of the manufacturer.

• Before the installing of a DCVA, ensure that the relief valves on the heating vessels (non-chemically treated) are in good working condition. If the relief valves are not functioning properly, pressure buildup may result in explosion or escape of hot liquid under high pressure. Also ensure that adequate drain pipes to floor drains are provided for this liquid.

• Thoroughly flush the lines before installing a DCVA.

• All DCVAs shall be installed in a horizontal position unless otherwise recommended by the manufacturer and approved by the Orange County Plumbing Code.

Before installation, refer to the manufacturer’s literature for temperature ranges. A DCVA must be protected from freezing temperatures. For temperatures of 110°F (43°C) or above, consult manufacturer’s literature for recommendations.

The DCVA shall be installed “in line” and should be the same size as the supply and discharge piping.

**Pressure Vacuum Breaker (PVB) Description (PVB).** A pressure vacuum breaker assembly consists of an independently operating internally loaded check valve and an independently operating loaded air inlet valve located on the discharge side of the check valve, with properly located resilient-seated test cocks and tightly closing resilient-seated shutoff valves attached at each end of the assembly (Figure 2-16). **Approved Standards (PVB):** shall conform to ASSE standard 1020 or standards of USC FCCC & HR.

Figure 2-16 Pressure vacuum breaker assembly.
**Function (PVB).** Figure 2-17 indicates a normal flow situation in which the internally loaded check valve remains open, and the air inlet valve is closed.

Figure 2-17 Pressure vacuum breaker assembly: normal flow condition.

![Diagram of normal flow condition]

When a backsiphonage condition develops, the internally loaded check valve closes. And, if this check is not fouled, it precludes the backsiphonage of water from the PVB body and downstream piping. However, if the check valve is fouled, the air inlet valve opens with the cessation of normal flow and allows air to enter the supply pipe through the fouled check valve, thus, breaking the vacuum and not permitting backsiphonage from the downstream piping (Figure 2-18).

**Application (PVB).** The PVB is effective against backflow caused by backsiphonage only and should not be used if backpressure could develop in the downstream piping.

Figure 2-18 Pressure vacuum breaker: backsiphonage condition.

![Diagram of backsiphonage condition]

The PVB is normally used at irrigation connections to protect against both pollutants and contaminants (Figure 2-19).
Figure 2-19 Typical pressure vacuum breaker applications.

If used for health hazards, careful consideration must be given to the possibility of the assembly being circumvented. Where such possibilities exist, area or premises isolation is necessary. Refer to Appendix C for explanation of symbols.

**Installation (PVB).** Following are several installation considerations. For more information, refer to the manufacturer’s specifications.

If the PVB is used to isolate a health hazard, the potential for circumvention of the assembly and the possibility of backpressure exists, and then premises isolation with an RPBA may be necessary.

- The PVB is designed to operate under constant pressures for long periods of time.
- The PVB shall be installed at least 12 in. (305 mm) above downstream piping and the highest fixture flood level rim, outlet, or highest point of water use.
- The PVB shall be installed in a vertical position with adequate space to facilitate maintenance and testing.
- The PVB shall be installed in an area where water spillage through the vacuum relief valve (air vent) is not objectionable. Provide adequate drainage to floor drains to accommodate this spillage.
- The PVB shall not be installed in a vent hood or where toxic or objectionable fumes could enter and contaminate the potable water piping.
- The PVB shall be installed “in line” and should be the same size as the supply and discharge piping.
• Low inlet-supply pressure will make closing of the air inlet port very difficult. Additionally, water hammer often occurs when the air inlet valve closes.
• Before installation, refer to the manufacturer’s literature for temperature ranges. The PVB must be protected from freezing temperatures. If installed where temperatures will reach 110°F (43°C) or above, the hot-water type of assembly must be used.
• Where test cocks are threaded, these test cocks shall be plugged and not used for any other purpose except for testing, as is the intent of the manufacturer.
• Device shall be supported to prevent sagging.

Atmospheric Vacuum Breaker (AVB)

Description (AVB). The atmospheric vacuum breaker is a backflow prevention assembly that performs similarly to a pressure vacuum breaker. The AVB consists of a float check, a check seat, and an air inlet port. Approved Standards (AVB): shall conform to ASSE standard 1001 or standards of USC FCCC & HR. A shutoff valve immediately upstream may be an integral part of the assembly (Figure 2-20).

Figure 2-20 Atmospheric vacuum breaker assembly.
During normal flow conditions, the float with the AVB seals against the air inlet seat as shown in Figure 2-21.

Figure 2-21 under normal flow conditions the AVB seals against the air inlet seat.

When a backsiphonage condition develops the cessation of normal flow permits the float to drop, thus opening the air inlet valve. If the float seals against a check seat there is no backsiphonage from the AVB body or downstream piping. However, if the float check is fouled, then the air entering through the air inlet valve dissipates the vacuum through the fouled check valves, thus preventing backsiphonage into the supply piping. See Figure 2-22.

Figure 2-22 Atmospheric vacuum breaker: backsiphonage condition.

Application (AVB). The AVB is effective against backflow caused by backsiphonage only and shall not be used if backpressure could develop in the downstream piping.
Figure 2-23 Typical atmospheric vacuum breaker applications.

The AVB should be used for protection against non-health hazards (Figure 2-23). Like the PVB, if used to isolate a health hazard, additional area or premises isolation may be required (see Figure 2-10). This assembly is not for use at a meter.

Installation (AVB). Following are several design installation specifications. For more information, refer to the manufacturer’s recommendations and the latest approved Orange County Plumbing Code.

- The AVB shall not be installed where it will be in continuous operation for more than 12 hours. When used for long periods of time, the air inlet disc could become stuck in the closed position.
- The AVB shall be installed downstream of the last shutoff valve in a system, such that the discharge side is exposed to atmosphere. Any means of shutoff on the outlet side, such as a hose attachment that would allow a hose with a valve to be connected for a long period, could cause a static pressure condition that would keep the air inlet disc in the closed position.
- The AVB shall be installed “in line” and should be the same size as the supply and discharge piping.
- The AVB shall be installed a minimum of 6 in. (152 mm) above all downstream piping and the highest outlet or flood level rim.

Refer to Appendix C for explanation of symbols.
• The AVB shall not be installed in a vent hood or where toxic or objectionable fumes could enter and contaminate the potable water piping. The AVB shall be installed in a visible location for maintenance.
• The AVB shall be installed in an area where water spillage is not objectionable. Provide adequate drainage to floor drains to accommodate this spillage.
• Before installation, refer to the manufacturer’s literature for temperature ranges. AVBs must be protected from freezing temperatures, and if installed where temperatures will reach 110- F (43-C) or above, the hot-water type of assembly must be used.

**Dual Check Valve Backflow Preventer (DC) (standard ASSE 1024)** is not approved for use within Orange County Utilities water service area. The customer with the current plumbing code requirements shall replace existing Dual Check backflow preventers installed prior to this manual if dual check is found defective.

**Approved Standards, Hose Connection Vacuum Breakers (HCVB):** shall conform to ASSE standard 1011. Installation enforcement through Orange County Plumbing Codes and Appendix (E) Section 608.13.6 Florida Building Code-Plumbing

| References | 
| --- | --- |
| 1 | Standard for Reduced-Pressure Principle Backflow Prevention Assembly. AWWA Standards C511-89. AWWA, Denver (1990) |
| 2 | Manual of Cross Connection Control. Foundation for Cross Connection Control and Hydraulic Research, Univ. of South California, Los Angeles (9th ed., 1995) |
Typical Hazards

The Orange County Utilities Department and Orange County Building Division will review and evaluate the hazards inherent in supplying a customer’s water system, that is, to determine whether solid, liquid, or gaseous pollutants or contaminants are or may be handled on the consumer’s premises in such a manner as to probably permit pollution or contamination of the public potable water system. When a hazard or potential hazard to the public water system is found on the customer’s premises, the customer shall install an approved and appropriate backflow-prevention assembly at each water service connection to the premises and/or at key locations on the premises. The type and location of assembly to be installed depends on the nature of the hazard involved.

If there is a change in water use on the premises that would affect the type of hazard to the public water system, the customer shall inform the Orange County Utilities Department and the Orange County Building Division. Tables 2-1 and 2-2 provide protection guidance. The customer’s backflow prevention assembly shall be matched to the appropriate hazard for containment protection.

3.1 TYPICAL HAZARDOUS CHEMICALS FOUND ON PREMISES

Many chemicals or chemical compounds may create a hazard to the public system when injected or otherwise introduced into the water system. To minimize the risk from these kinds of contaminants and hazards, a particular type premises containment assembly is recommended. Some of the activities occurring within the premises follow.

Agriculture/Exterminators

Agriculture and commercial exterminators use solutions for many purposes. The following are some of the chemical compounds that may be injected into irrigation systems for spreading purposes. All of them are toxic in concentrated solutions.

Fertilizers. Ammonium salts, ammonia gas, phosphates, and potassium salts.

Herbicides. 2,4-D, dinitrophenol, 2,4,5-T, sodium chlorate, borax, sodium arsenite and methyl bromide.

Pesticides. DDT, TDE, BHC, lindane, TEPP, parathion, Malathion, nicotine, and others.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.
Cooling Systems  --- Open or Closed

Cooling systems - including cooling towers - usually require some treatment of the water for algae, slime, or corrosion control.

Chemicals frequently used for this purpose may include the following highly toxic chemicals: quaternary ammonium compounds, pentachlorophenol, mercury, chromium; or the following chemicals that are toxic in higher concentrations: chlorine, bromine, copper, permanganate, glucosides, and ozone.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

Dye Plants

Most solutions used in dyeing are highly toxic. The toxicity depends on the chemicals used and their concentrations. The following types or chemical groups of dyes are generally used: vat dye, mordant dye, chrome dye, nitro dye, metallized dye, thiazol dye, and analine dye.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

Plating Plants

In plating work, materials are first cleaned in acid or caustic solutions at concentrations that are highly toxic. Afterwards, they are immersed in plating solutions that are highly toxic. Such solutions may contain cyanides, fluorides, or metals in solution, such as copper, chromium, nickel, cadmium, antimony, silver salts, and so forth.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

Steam Boiler Plants

Most boiler plants will use some form of boiler feed water treatment. The chemicals normally used for this purpose include highly toxic compounds, such as cyclohexylamine, hydrazine, morpholine, benzylamine; or the less toxic compounds, such as acids, sodium hydroxide, sodium sulphite, sodium phosphate, sodium nitrate, sodium aluminate, and sodium alginate.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.
3.2 TYPICAL CROSS CONNECTION OCCURRENCES AND RECOMMENDED PROTECTION

Auxiliary Water Systems

An approved backflow prevention assembly shall be installed at the service connection to any premises where there is an auxiliary water supply or system, even though there is no connection between the auxiliary water supply and the public potable water system. Orange County Building Division or Orange County Utilities Department, through its inspection, reserves the discretionary right to assign a hazard and the relative risk assigned to particular types of auxiliary water supply.

The term *auxiliary water supply* is commonly used to describe water supplies or sources not under the control or the direct supervision of the Orange County Utilities Department. Typical of such water supplies are natural waters derived from wells, springs, streams, rivers, lakes, harbors, bays and oceans. Also considered an auxiliary water supply, is reclaimed water and used waters that have passed beyond the control (at the point of delivery) of the Orange County Utilities Department and that may be stored, transmitted, or used in such a manner as to pollute. Finally, there may be public potable water supplies furnished by some other water purveyor that may or may not be under good sanitary control.

Types of used water supplies include:

- water in industrialized water systems;
- water in reservoirs or tanks used for fire-fighting purposes;
- irrigation reservoirs;
- swimming pools, fish ponds, and mirror pools;
- memorial and decorative fountains and cascades;
- cooling towers;
- baptismal, quenching, washing, rinsing, and dipping tanks.

All of these supplies, including a public potable water system in which Orange County Utilities Department does not exercise sanitary control, are potential hazards to the County water system. These waters might become polluted or contaminated because of industrial processes; contact with human body, dust, vermin, birds, or by means of chemicals that may have been introduced into the tanks, lines, or systems for scale, corrosion, algae, bacterial, or odor control. Therefore, it is necessary for Orange County Building Division or the Orange County Utilities Department to evaluate the potential hazard inherent in a particular auxiliary water source and to take the necessary steps to protect the public water system according to the degree of hazard found.

In making such an evaluation, it is the judgment of the inspection personnel of the Orange County Building Division or Orange County Utilities Department to determine if hazards are low and there is little or no chance of the auxiliary water sources being developed and interconnected with the potable water system through cross connections. It is only necessary to determine that the water or fluids are available to the premises and of a quantity sufficient to make it desirable and feasible for the
consumer to develop and use the supply. The need to install the proper backflow prevention assembly is still required.

For administrative purposes, auxiliary water supplies are divided into the following four general classifications:

- reclaimed water;
- an approved public potable water supply over which Orange County Utilities Department does not have sanitary control;
- any private water supply, (typically wells) other than Orange County Utilities Department approved public potable water supply, on or available to the premises; and
- used waters and industrial fluids, such as waters in reservoirs, cooling towers, recirculation systems, industrial fluid systems, and so forth.

**Protection recommended.** In the following examples, the degree of hazard is classified and the type of backflow prevention assembly is recommended.

**Public potable water system.** Interconnection with an approved backflow prevention assembly shall be required on any direct interconnection (except as noted hereafter) between the approved public potable water supply and any other approved public potable water supply over which Orange County Utilities Department does not have sanitary control. This may be accomplished in the following manner:

- an air-gap separation or a reduced pressure principle backflow prevention assembly is recommended at the service connection when the auxiliary water supply is or may be contaminated to a degree that would constitute a health hazard.
- a double check valve assembly is recommended at the service connection when the auxiliary water supply is being operated under a public health permit but is not acceptable to the Orange County Utilities Department as a source.
- no backflow protection at the service connection is recommended if the auxiliary water system has a properly conducted sanitary control program in force, and the auxiliary water supply is acceptable to the Orange County Utilities Department as a source.

**Private water supply.** An approved backflow prevention assembly shall be installed at the service connection to any premises in which there is any available water supply other than Orange County Utilities Department’s public potable water supply. This may be accomplished in the following manner:

- an air-gap separation or a reduced pressure principle backflow prevention assembly is recommended at each service connection when the auxiliary water supply is or may be contaminated to a degree that would constitute a health or system hazard.
- a double check valve assembly is recommended at each service connection when the auxiliary water supply is or may be subject to pollution, such as when there is no health or system hazard.

**Used waters and industrial fluids.** An approved backflow prevention assembly shall be
installed at the service connection to any premises on which there is a used water supply or a system containing industrial fluids. This will include premises where there are reservoirs, cooling towers, recirculation systems, and other used-water or industrial-fluid systems. This may be accomplished in the following manner:

- an air gap separation or a reduced pressure principle backflow prevention assembly is recommended where there is a health hazard.
- a double check valve assembly should be used where there is only a pollution hazard.

Reclaimed Water

Reclaimed Water Supply. Cross connections between the customer’s potable water system and the customer’s reclaimed water system are prohibited in accordance with Florida Administrative Code (F.A.C.) Chapter 62-555.360. The use of reclaimed water shall conform to Orange County Utilities Reclaimed Water Ordinance 94-21 and Chapter 62-610 of the F.A.C.

Inspections in Reclaimed Areas. The customer’s potable water system or reclaimed water system shall be open for inspection at all reasonable times to authorized representatives of Orange County Building Division or Orange County Utilities Department. The inspection will verify no cross connections exist between the potable water and the reclaimed systems.

Beverage Bottling Plants and Breweries

An approved backflow prevention assembly shall be installed on the service connection to any premises where a beverage bottling plant is operated or maintained and water is used for industrial purposes.

The hazards normally found in a plant of this type include cross connections between the potable water system and:

- steam-connected facilities, such as pressure cookers, autoclaves, retorts, and so forth;
- washers, cookers, tanks, lines, flumes, and other equipment used for storing, washing, cleaning, blanching, cooking, flushing, fluming or for transmission of food, fertilizers, or wastes;
- can and bottle washing machines;
- lines in which caustics, acids, detergents, and other compounds are used in cleaning, sterilizing, and flushing;
- reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as pentachlorophenol, copper sulfate, chromates, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
- steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above (NOTE: A very particular hazard is the possibility of steam getting back into the domestic system, causing either a system or a health hazard);
• industrial-fluid systems and lines containing cutting and hydraulic fluids, coolants, hydrocarbon products, glycerine, paraffin, caustic and acid solutions, and so forth;
• water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;
• fire-fighting systems, including storage reservoirs that may be treated for prevention of scale formation, corrosion, algae, slime growths, and so forth; fire systems that may be subject to contamination with antifreeze solutions, liquid foam concentrates, or other chemicals or chemical compounds used in fighting fire, or fire systems that are subject to contamination with auxiliary or used water supplies, or industrial fluids.

Protection recommended: An air gap separation or a reduced pressure principle backflow prevention assembly is recommended where there is a health hazard. A double check valve assembly should be used where there is only a pollution hazard.

Canneries, Packing Houses, and Reduction Plants

An approved backflow prevention assembly shall be installed at the service connection to any premises where vegetable or animal matter is canned, concentrated, or processed.

The hazards normally found in a plant of this type include cross connections between the potable water system and;

• steam-connected facilities, such as pressure cookers, autoclaves, retorts, and so forth;
• washers, cookers, tanks, lines, flumes, and other equipment used for storing, washing, cleaning, blanching, cooking, flushing, fluming, or for transmission of food, fertilizers, or wastes;
• reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as pentachlorophenol, copper sulfate, chromates, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
• steam-generating facilities and lines that may be contaminated with boiler compounds, such as the chemicals listed above (NOTE: A very particular hazard is the possibility of steam getting back into the domestic system, causing either a health or a system hazard);
• industrial-fluid systems and lines containing cutting and hydraulic fluids, coolants, hydrocarbon products, glycerine, paraffin, caustic and acid solutions, and so forth;
• fire-fighting systems, including storage reservoirs that may be treated for prevention of scale formation, corrosion, algae, slime growths, and so forth; fire systems that may be subject to contamination with antifreeze solutions; liquid foam concentrates or other chemicals or chemical compounds used in fighting fire; or fire systems that are subject to contamination with auxiliary or used water supplies or industrial fluids;
water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;

- tanks, can and bottle washing machines, and lines in which caustics, acids, detergents, and other compounds are used in cleaning, sterilizing, and flushing.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

Chemical Plants - Manufacturing, Processing, Compounding, or Treatment

An approved backflow prevention assembly shall be installed on the service connection to any premises where there is a facility requiring the use of water in the industrial process of manufacturing, storing, compounding, or processing chemicals. This will also include facilities where chemicals are used as additives to the water supply or in processing products.

This is a very broad category and will require careful consideration of the processes involved in the plants. Water for manufacturing purposes is requisite for most chemical plants and is used to purge lines and clean vats and tanks, as well as for process water. Cross connections in such plants may be numerous because of the intricate piping. The severity of these cross connections varies with the toxicity of chemicals used.

The hazards normally found in a plant of this type include cross connections between the potable water system and:

- formulating tanks and vats, decanter units, extractor/precipitators, and other processing units that may be heavily contaminated with highly toxic end-products or other toxic waste by-products, including such contaminants as organo-phosphate derivatives, organo-nitrogen compounds, chlorinated-aimes, chlorinated-dibenzo-furans, and so forth;

- reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as chromates, pentachlorophenol, copper sulfate, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;

- steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above (NOTE: A very particular hazard is the possibility of steam getting back into the domestic system, causing either a system or a health hazard);

- industrial-fluid systems and lines containing cutting and hydraulic fluids, coolants, hydrocarbon products, glycerine, paraffin, caustic and acid solutions, and so forth;

- fire-fighting systems, including storage reservoirs that may be treated for prevention of scale formation, corrosion, algae, slime growths, and so forth; fire systems that may be subject to contamination with antifreeze solutions, liquid foam concentrate or other chemicals or chemical compounds used in
• fighting fire; or fire systems that are subject to contamination with auxiliary or used water supplies or industrial fluids;
• water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;
• hydraulically operated equipment for which the city water pressure is used directly and may be subject to backpressure;
• equipment under hydraulic tests, such as tanks, lines, valves, fittings, pumps, pressure cylinders, or other hydraulic facilities that may be used to provide pressure for testing purposes (NOTE: In such cases, air, gas, or hydraulic fluids may be forced back into the public system);
• pressure cookers, autoclaves, retorts, and other similar steam-connected facilities;
• washers, cookers, tanks, flumes, and other equipment used for storing, washing, cleaning, blanching, cooking, flushing, fluming, or for transmission of food, fertilizers, or wastes.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended where there is a health hazard.

Dairies and Cold Storage Plants

An approved backflow prevention assembly shall be installed on the service connection to any premises on which a dairy, creamery, ice cream plant, cold storage, or ice manufacturing plant is operated or maintained, provided such a plant has on the premises an industrial-fluid system, sewage handling facilities, or other similar source of contamination that, if cross connected, would create a hazard to the public system.

The hazards normally found in a plant of this type include cross connections between the potable water system and:

• reservoirs, cooling towers, and circulation systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as pentachlorophenol, copper sulfate, chromates, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
• steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above (NOTE: A very particular hazard is the possibility of steam getting back into the domestic system, causing either a system or health hazard);
• water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;
• tanks, can and bottle washing machines, and lines in which caustics, acids, detergents, and other compounds are used in cleaning, sterilizing, and flushing.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended where there is a health hazard. A double check valve assembly should be used where there is only a pollution hazard.
**Film Laboratories**

An approved backflow prevention assembly shall be installed on each service connection to any premises where a film laboratory, processing, or manufacturing plant is operated or maintained. (This does not include small darkroom facilities.)

The hazards normally found in a plant of this type include cross connections between the potable water system and:

- tanks, automatic film-processing machines, or other facilities used in processing films that may be contaminated with chemicals, such as acetic acid, potassium ferricyanide, and/or one of the many different types of the aromatic series of organic chemicals;
- water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth.

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

**Hospitals, Medical Buildings, Sanitariums, Morgues, Mortuaries, Autopsy Facilities, and Clinics**

An approved backflow prevention assembly shall be installed on the service connection to any hospitals, medical buildings, and clinics.

The hazards normally found in a facility of this type include cross connections between the potable water system and:

- contaminated or sewer-connected equipment, such as bedpan washers, flush valve toilets and urinals, autoclaves, specimen tanks, sterilizers, pipet tube washers, cuspidors, aspirators, autopsy and mortuary equipment, and so forth (NOTE: It has been found that in this type of facility, little or no attention is given to the maintenance of air-gap separations or vacuum breakers. It is customary to bridge an air-gap separation by means of a hose section. Also, in multistoried buildings, the supply line to the toilets, urinals, lavatories, laboratory sinks, and so forth, on the lower floors may be taken off the suction side of the hose pump and, as a result, sewage or other contaminated substances may be drawn into the hose supply line.);
- water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;
- reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as pentachlorophenol, copper sulfate, chromates, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above. (NOTE: A specific hazard is the possibility of steam getting back into the domestic system, causing either a system or health hazard.)

**Protection recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly shall be installed on the service connection to any hospital, mortuary, morgue, autopsy facility, or to any multistoried medical building or clinic.

**Laundries and Dye Works (Commercial Laundries)**

An approved backflow prevention assembly shall be installed on each service connection to any premises where a laundry or dyeing plant is operated or maintained. A laundry, as used herein, does not include the self-service or so-called Laundromats® except where such laundry equipment constitutes a cross connection.

The hazards normally found in a plant of this type include cross connections between the potable water system and:

- laundry machines having under-rim or bottom inlets;
- dye vats in which toxic chemicals and dyes are used;
- water storage tanks equipped with pumps and recirculating systems;
- shrinking, blueing, and dyeing machines with direct connections to circulating systems;
- retention and mixing tanks (NOTE: Some of the machines or the equipment have pumps that can pump contaminated fluids through cross connections into the public water supply.)
- sewage pumps for priming, cleaning, flushing, or unclogging purposes;
- water-operated sewage sump ejectors for operational purposes;
- sewer lines for the purpose of disposing of filter or softener backwash water from cooling systems, for quick draining of building lines, or for flushing or blowing out obstructions, and so forth;
- reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as pentachlorophenol, copper sulfate, chromates, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
- steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above. (NOTE: A specific hazard is the possibility of steam getting back into the domestic system, causing either a system or a health hazard.)

**Protection recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.
Marine Facilities and Dockside Watering Points

The actual or potential hazard to the Orange County Utilities Department water system created by any marine facility or dockside-watering point must be individually evaluated. The basic risk to a domestic water system is due to the possibility that contaminated water can be pumped into the domestic water system by the fire pumps or other pumps aboard a ship. In addition to the normal risk peculiar to dockside watering points, risks are found at those areas where dockside-watering facilities are used in connection with marine construction, maintenance and repair, and permanent or semi-permanent moorages.

Protection recommended. Minimum system protection for marine installations may be accomplished in one of the following ways:

- Water connections directly to vessels for any purpose must have an RPBA installed at the pier hydrants (Figure 3-1). All hydrants in the dockside area used (or available for use) in providing water to vessels should be so protected. If an auxiliary water supply is used, such as a salt-water fire system, the entire dockside area should also be isolated from the water supplier’s system by an AG (see Figure 3-1).
- Where water is delivered to marine facilities for fire protection only, and no auxiliary supply is present, all service connections should be protected by an RPBA. If there are hydrants available for connection to a vessel’s fire system, then an RPBA should be installed at the user connections as well.
- Water delivered to a marine repair facility should have an RPBA installed at the user connection (see Figure 3-2).
- Water delivered to small boat moorages that maintain hose bibbs on a dock or float should have an RPBA installed at the user connection and a hose connection vacuum breaker (HCVB) on all hose bibbs. If a sewage pump station is provided, the area should be isolated by installation of an RPBA.
- Water for fire protection aboard ship, connected to dockside fire hydrants, shall not be taken aboard from fire hydrants, unless the hydrants are on a fire system separated from the domestic system by an approved RPBA or the hydrant is protected by a portable, approved RPBA.
Figure 3-1 Premises Isolation
Figure 3-2 Premises isolation - marine repair and marine cargo handling facilities.
Metal Manufacturing, Cleaning, Processing, and Fabricating Plants

An approved backflow prevention assembly shall be installed on the service connection to any premises where metals are manufactured, cleaned, processed, or fabricated, and the process involves used waters and/or industrial fluids. This type of facility may be operated or maintained either as a separate function or other facility, such as an aircraft or automotive manufacturing plant.

The hazards normally found in a plant of this type include cross connections between the potable water system and:

- reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as pentachlorophenol, copper sulfate, chromates, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
- steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above (NOTE: A specific hazard is the possibility of steam getting back into the domestic system, causing either a system or a health hazard.);
- industrial-fluid systems and lines containing cutting and hydraulic fluids, coolants, hydrocarbon products, glycerine, paraffin, caustic and acid solutions, and so forth;
- plating facilities involving the use of highly toxic cyanides, heavy metals in solution, such as copper, cadmium, chrome, nickel, and so forth; acids and caustic solutions;
- plating-solution filtering equipment with pumps and circulating lines;
- tanks, vats, or other vessels used in painting, descaling, anodizing, cleaning, stripping, oxidizing, etching, passivating, pickling, dipping, or rinsing operations, or other lines or facilities needed in the preparation or finishing of products;
- water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;
- tanks, can and bottle washing machines, and lines in which caustics, acids, detergents, and other compounds are used in cleaning, sterilizing, and flushing.
- hydraulically operated equipment for which the water utility water pressure is used directly and may be subject to backpressure;
- equipment under hydraulic tests, such as tanks, lines, valves, fittings, and also pumps, pressure cylinders, or other hydraulic facilities that may be used to provide pressures for testing purposes (NOTE: In such cases, air, gas, or hydraulic fluids may be forced back into the public system.)

Protection recommended. An air gap separation or a reduced pressure principle backflow prevention assembly is recommended where there is a health hazard. A double check valve assembly should be used where there is only a pollution hazard.
Multistoried Buildings

Multistoried buildings may be broadly grouped into the following three categories in terms of their internal potable water systems:

- using only the service pressure to distribute the potable water throughout the structure, and with no internal potable water reservoir;
- using a booster pump to provide potable water directly to the upper floors;
- using a booster pump to fill a covered roof reservoir from which there is a down-feed system for the upper floors.

Considerable care must be exercised to prevent the use of the suction-side line to these pumps from also being used as the takeoff for domestic, sanitary, laboratory, or industrial uses on the lower floors. Pollutants or contaminants from equipment supplied by takeoffs from the suction-side line may be easily pumped throughout the upper floors.

In each of the systems described above, it is probable that there are one or more takeoffs for industrial water within the building. Any loss of distribution main pressure will cause backflow from these building’s systems unless approved backflow prevention assemblies are properly installed.

Protection recommended.

- an air gap separation or a reduced pressure principle backflow prevention assembly is recommended where there is a health hazard;
- a reduced pressure principle backflow prevention assembly when takeoffs for lower floor sanitary facilities are connected to the suction side of booster pump(s);
- a double check valve assembly should be used where there is a non-health hazard.

The suction pressure on booster pumps should be limited to prevent drawing water from adjacent unprotected premises.

Oil and Gas Production, Storage or Transmission Properties

An approved backflow prevention assembly shall be installed at the service connection to any premises where animal, vegetable, or mineral oils and gases are produced, developed, processed, blended, stored, refined, or transmitted in a pipeline, or where oil or gas tanks are maintained. An approved backflow prevention assembly shall be installed at the service connection where an oil well is being drilled, developed, operated, or maintained; or where an oxygen, acetylene, petroleum, or other natural or manufactured gas production or bottling plant is operated or maintained. Such premises should also include locations where oil or gas tanks, bottling or other storage or pressure vessels are repaired, tested, or maintained; premises having dehydration or refinery facilities; premises where the water service is used for “slugging” oil or gases through transmission lines; or where the water service is used for testing or purging oil and gas tanks or oil and gas pipelines, and other similar uses.
The hazards normally found in a plant of this type include cross connections between the potable water system and:

- steam boilers and lines;
- mud pumps and mud tanks;
- hydraulically operated “Tretolite” tanks;
- oil-well casings (for dampening pressures);
- dehydration tanks and outlet lines from storage and dehydration tanks (for purging purposes);
- oil and gas tanks (to create hydraulic pressures and to hydraulically raise the oil and gas levels);
- gas and oil lines (for testing, evacuating, and slugging purposes);
- reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as chromates, pentachlorophenol, copper sulfate, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
- steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above (NOTE: A specific hazard is the possibility of steam getting back into the domestic system, causing either a system or a health hazard);
- industrial-fluid systems and lines containing cutting and hydraulic fluids, coolants, hydrocarbon products, glycerine, paraffin, caustic and acid solutions, and so forth;
- fire-fighting systems, including storage reservoirs that may be treated for prevention of scale formation, algae, slime growths, and so forth; fire systems that may be subject to contamination with antifreeze solutions, liquid foam concentrate or other chemicals or chemical compounds used in fighting fire; or fire systems that are subject to contamination with auxiliary or used water supplies or industrial fluids.
- water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;
- hydraulically operated equipment where the water utility pressure is being used directly and may be subject to backpressure;
- equipment under hydraulic tests, such as tanks, lines, valves, fittings, and also pumps, pressure cylinders, or other hydraulic facilities that may be used to provide pressures for testing purposes (NOTE: In such cases, air, gas, or hydraulic fluids may be forced back into the public system.)

**Protection recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.
Paper and Paper Product Plants

An approved backflow prevention assembly shall be installed on the service connection to any premises where a paper or paper products plant (wet process) is operated or maintained. Paper or paper product plants as used here means those plants where used waters, industrial fluids, and chemicals are used in the manufacturing process.

The hazards normally found in a plant of this type include cross connections between the potable water system and:

- pulp, bleaching, dyeing, and processing facilities that may be contaminated with toxic chemicals;
- reservoirs, cooling towers, and circulating systems that may be heavily contaminated with vermin, algae, bacterial slimes, or with toxic water treatment compounds, such as chromates, pentachlorophenol, copper sulfate, metallic glucosides, compounds of mercury, quaternary ammonium compounds, and so forth;
- steam-generating facilities and lines that may be contaminated with boiler compounds, such as those chemicals listed above (NOTE: A specific hazard is the possibility of steam getting back into the domestic system, causing either a system or a health hazard);
- industrial-fluid systems and lines containing cutting and hydraulic fluids, coolants, hydrocarbon products, glycerine, paraffin, caustic and acid solutions, and so forth;
- water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;
- fire-fighting systems, including storage reservoirs that may be treated for prevention of scale formation, corrosion, algae, slime growths, and so forth; fire systems that may be subject to contamination with antifreeze solutions, liquid foam concentrate or other chemicals or chemical compounds used in fighting fire; or fire systems that are subject to contamination with auxiliary or used water supplies or industrial fluids.

**Protection recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

Plating Plants

An approved backflow prevention assembly shall be installed at the service connection to any premises where there is a mechanical, chemical, or electrochemical plating or processing plant. This plating plant or facility may be operated or maintained either as a separate function or in conjunction with a manufacturing or other facility, such as an aircraft or automotive manufacturing plant. Plating as used here includes such operations as chromium, cadmium, or other plating, galvanizing, anodizing, cleaning, stripping, oxidizing, etching passivating, pickling, and so forth.
The hazards normally found in a plant of this type include cross connections between the potable water system and:

- plating solution filtering equipment with pumps and circulating lines;
- tanks, vats, or other vessels used in painting, descaling, anodizing, cleaning, stripping, oxidizing, etching, passivating, pickling, dipping, or rinsing operations, or other lines or facilities needed in the preparation of finishing of the products;
- steam-generating facilities and lines that may be contaminated with boiler compounds, such as pentachlorophenol, copper sulfate, chromates, metallic glucosides, compounds of mercury and so forth. (NOTE: A specific hazard is the possibility of steam getting back into the domestic system, causing either a system or a health hazard);
- water-cooled equipment that may be sewer connected, such as compressors, heat exchangers, air-conditioning equipment, and so forth;

**Protection Recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

**Water Hauling Equipment**

An approved backflow prevention assembly shall be installed on any portable spraying or cleaning units that have the capability of connection to any potable water supply that does not contain a built-in approved air gap.

The hazards normally found in water-hauling equipment include cross connections between the potable water system and:

- contaminated tanks with toxic chemical compounds used in spraying fertilizers, herbicides, and pesticides;
- water-hauling tanker trucks used in dust control;
- other tanks on cleaning equipment.

**Protection recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly is recommended as shown in Figure 3-3. There may be times when the inspection and maintenance of RPBAs on portable units are questionable. Under such circumstances, the water supplier may wish to designate specific watering points, such as those equipped with air gaps, for filling portable units.
Figure 3-3 Approved methods of filling water-hauling equipment where temperatures are above freezing.
Radioactive Material or Substances - Plants or Facilities Handling

An approved backflow prevention assembly shall be installed at the service connection to any premises where radioactive materials or substances are processed in a laboratory or plant, or where they may be handled in such a manner as to create a potential hazard to the water system, or where there is a reactor plant.

**Protection recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

Restricted, Classified, or Other Closed Facilities

An approved backflow prevention assembly shall be installed on the service connection to any facility that is not readily accessible for inspection by the water purveyor because of military secrecy requirements or other prohibitions or restrictions.

**Protection recommended.** An air gap separation or a reduced pressure principle backflow prevention assembly is recommended.

Solar Domestic Hot Water Systems

An approved backflow prevention assembly shall be installed on the service connection to any premises where there is a solar domestic hot-water system.

The hazards normally found in a solar domestic system include cross connections between the potable water system and heat exchangers, tanks, and circulating pumps. Depending on the system’s design, the heat transfer medium may vary from domestic water to antifreeze solutions, corrosion inhibitors, and gases. The associated degree of hazard will range from a non-health hazard, when potable water is used, to a health hazard, when a toxic transfer medium, such as ethylene glycol, is used. Contamination occurs when the piping or tank walls of the heat exchanger between the potable hot water and the transfer medium begins to leak.

Solar heat exchangers can be classified in the following liquid-to-liquid types:

**Single wall with no leak protection (SW).** A heat exchanger that provides a single wall separation between the domestic hot water and the transfer medium. Failure of this wall will result in a cross connection between the domestic hot water and heat transfer medium.
Table 3-1 Recommended Protection for Solar Heat Exchangers

<table>
<thead>
<tr>
<th>Hazard Rating of Transfer Medium</th>
<th>Heat Exchanger</th>
<th>Recommended Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-health</td>
<td>SW</td>
<td>DCVA</td>
</tr>
<tr>
<td>Non-health</td>
<td>DW, DWP</td>
<td>None*</td>
</tr>
<tr>
<td>Health</td>
<td>SW, DW</td>
<td>RPBA</td>
</tr>
<tr>
<td>Health</td>
<td>DWP</td>
<td>None</td>
</tr>
</tbody>
</table>

Note: DCVA = double check valve backflow-prevention assembly; DW = double wall, no leak protection; DWP = double wall with leak protection; RPBA = reduced-pressure principle backflow prevention assembly; SW = single wall with no leak protection.

* May require backflow protection.

**Double wall with no leak protection (DW).** A heat exchanger that has two separate distinct walls separating the potable water and the transfer medium. A cross connection between the potable hot-water system and the transfer medium would require an independent failure of both walls.

**Double wall with leak protection (DWP).** A heat exchanger that has two separate distinct walls separating the potable hot water and the transfer medium. If a leak should occur in one or both walls of the DWP, it will be indicated by the transfer medium flowing to the outside of the heat exchanger.

**Protection recommended.** The recommendations in Table 3-1 are to be used as a guide to recommend protection for solar domestic hot-water systems.
Backflow Prevention and Fire Protection

Like other situations encountered in cross connection control, the degree of backflow protection necessary for a particular fire-protection system will depend on specific conditions present. Generally, it is recommended that the potable water supply be protected when serving fire systems. Guidelines given in this chapter pertaining to fire booster pumps should also be noted.

The Orange County Utilities Department could require more backflow protection depending on the particular circumstances. For example a reduced pressure assembly may be installed within system piping to isolate only that portion of the system containing an antifreeze solution.

Pressure losses across backflow prevention assemblies do occur. This loss must be accounted for in the design or redesign of the fire protection system, if it is to function properly. This factor is particularly important when assemblies are added to existing fire-protection systems.

4.1 CLASSIFICATION FOR BACKFLOW PROTECTION

Industrial fire protection systems consist of sprinklers, hose connection(s), and hydrants. Sprinkler systems may be dry or wet, open or closed. Systems of fixed-spray nozzles may be used indoors or outdoors for protection of flammable liquids and other hazardous processes. It is standard practice, especially in cities, to equip automatic sprinkler systems with fire department pumper connections.

For cross connection control, fire-protection systems may be classified on the basis of water source and arrangement of supplies, as follows:

Class 1  Non-metered Dedicated Fire Lines. Direct connections from public water mains only; no pumps, tanks, or reservoirs; no physical connection from other water supplies; no antifreeze or other additives of any kind; all sprinkler drains discharging to atmosphere, dry wells, or other safe outlets (Figure 4-1). Requires installation of a Double Check Detector Check Backflow Preventer Assembly, Standard ASSE 1048 at the water service connection.
Figure 4-1  Class 1 fire-protection system.

**Class 2  Non-Metered Dedicated Fire Lines.** Same as Class 1, except that booster pumps may be installed in the connections from the street mains (booster pumps do not affect the potability of the system). It is necessary that pressure in the water main be not reduced below 20 psi. (Figure 4-2). Requires installation of a Double Check Detector Check Backflow Preventer Assembly, **Standard ASSE 1048** at the water service connection.

Figure 4-2  Class 2 fire-protection system.

**Class 3  Non-Metered Dedicated Fire Lines.** Direct connection from public water supply mains, plus one or more of the following: elevated storage tanks; fire pumps taking suction from above ground covered reservoirs, or tanks; and pressure tanks (Figure 4-3). (All storage facilities are filled or connected to public water only, the water in the tanks is to be maintained in a potable condition. Otherwise, Class 3 systems are the same as Class 1.) Requires installation of a Double Check Detector Check Backflow Preventer Assembly, **Standard ASSE 1048** at the water service connection.
Class 4  Non-Metered Dedicated Fire Lines. Directly supplied from public mains, similar to Class 1 and Class 2, with an auxiliary water supply dedicated to fire department use and available to the premises, such as an auxiliary supply located within 1,700 ft. (518 m) of the pumper connection (Figure 4-4). Requires installation of a Double Check Detector Check Backflow Preventer Assembly, Standard ASSE 1048 at the water service connection and for non-chemical, or Reduced Pressure Detector Assembly, Standard ASSE 1047 at the water service connection.

Figure 4-4  Class 4 fire-protection system.
**Class 5** *Non-Metered Dedicated Fire Lines.* Directly supplied from public mains and interconnected with auxiliary supplies, such as pumps taking suction from reservoirs exposed to contamination, or rivers and ponds; driven wells; mills or other industrial water systems; or where antifreeze or other additives are used (Figure 4-5). Requires installation of an Air-Gap or Reduced Pressure Detector Backflow Preventer Assembly, **Standard ASSE 1047** at the water service connection.

Figure 4-5 Class 5 fire-protection system.

**Class 6** *Non-Metered Dedicated Fire Lines.* Combined commercial or industrial and fire protection systems supplied from the public water mains only, with or without gravity storage or pump suction tanks (Figure 4-6). Requires installation of a Double Check Detector Check Backflow Preventer Assembly, **Standard ASSE 1048** at the water service connection and for non-chemical, non-toxic or Reduced Pressure Detector Backflow Preventer Assembly / Toxic, **Standard ASSE 1047** at the water service connection.

Figure 4-6 Class 6 combined commercial/industrial and fire-protection systems.
4.2 PROTECTION RECOMMENDED

Class 1, 2, and 3 Fire systems will generally require minimum protection (approved double detector check valve assembly) **Standard ASSE 1048** to prevent stagnant waters from back flowing into the public potable water system.

Class 4 Fire systems will normally require backflow protection at the service connection. The type (air gap, reduced pressure detector backflow prevention assembly **Standard ASSE 1047**, or double detector check valve assembly **Standard ASSE 1048**) will generally depend on the quality of the auxiliary supply.

Class 4 and 5 Fire systems require maximum protection (air gap or reduced pressure detector check backflow prevention assembly) to protect the public potable water system. Detector Assembly **Standard ASSE 1047**.

Class 6 Fire system protection would depend on the requirements of both industry and fire protection and could only be determined by a survey of the premises.

A meter (compound or detector check) is not normally permitted as part of a backflow protection assembly. However, an exception may be made if the meter and backflow prevention assembly are specifically designed for that purpose.

There are also chemicals, such as liquid foam concentrates used for fighting certain types of fires that are toxic and, therefore, require maximum protection. An Air-Gap or a Reduced Pressure Detector Check Backflow Preventer Assembly, **Standard ASSE 1047**.

NOTE: Where backflow protection is required on an industrial-domestic service that is located on the same premises, backflow protection should be provided on the fire service connection. The industrial-domestic system and fire systems in Classes 1, 2, 3, 4, 5 and 6 should have adequate protection for the highest degree of hazard affecting either system.

4.3 JOCKEY PUMPS

Fire protection systems may require the use of a jockey pump (an auxiliary pump with high-head and low-capacity characteristics) to maintain elevated pressure within the system. Discharge of a jockey pump must be on the downstream side of any check valve, double check valve assembly, or reduced pressure principle backflow prevention assembly, as appropriate by class. Supply for a jockey pump may be from either the upstream or downstream side of an assembly. If supply is taken from the upstream side, an assembly of the same type as required on the main line must be installed on the supply line. Figures 4-7 and 4-8 both show proper installation of a jockey pump. Figure 4-7 shows the entire assembly downstream of the backflow preventer, and Figure 4-8 shows a proper way to take supply from the upstream side of a backflow preventer.
4.4 BOOSTER PUMPS

Large volume fire pumps connected to a water main should be equipped with suction-limiting control to modulate the pump if suction pressure approaches 10 psi (69 kPa).

Ideally, such pumps should draw from an in-house reservoir, thus allowing pumped fire flows greater than the available water main capacity. Several supply lines increasing the security may feed the reservoir. If any of the lines have a source other than the potable water system, all input lines must have air gap discharges into the reservoir.
Maintenance and Testing Procedures

5.1 MAINTENANCE

It shall be the responsibility of the building premises owners or tenants to maintain, in good working condition, all backflow preventers within the building or on the premises. The following are a few helpful hints on general maintenance:

- All approved assemblies are designed for in-line repairs to eliminate the need to remove for service. Once removed, no protection is provided. Similarly, do not reassemble a backflow prevention device with any previously removed parts while waiting for delivery of replacement parts. A false sense of protection is given if the device appears to be operational.
- Clean all debris from strainers or screens on a regular basis.
- Valve springs on large assemblies are strong; remove with caution. Check manufacturer's procedures.
- Bleed off entrapped air after completing repairs and reassembly.
- On an RPB, the parts in check valve 1 are not necessarily interchangeable with the parts in check valve 2.
- If the RPB is continuously draining from the relief port, the first check valve, the second check valve, or the relief valve has failed. Clean the check valves of possible debris and check elastomeric disks for damage.
- If shutoff valve 2 on the RPB is closed tight and water begins to discharge from the relieve valve port, the check valve 1 or the relief valve diaphragm is probably leaking. Clean the check valve of possible debris, and check elastomeric disks for damage.
- If both shutoff valves to an RPB are closed and test cock 2 is open, water should begin to discharge from the relief valve port. Refer to the manufacturer's recommendations for additional maintenance instructions.

5.2 TESTING

There are a number of mechanical devices that have been approved as acceptable protection against backflow. To ensure continued satisfactory operation of backflow prevention assemblies, they must be tested by individuals who are registered by Orange County Building Division. All backflow prevention assemblies shall be equipped with test cocks and shall be tested annually or as directed by the water supplier. The following conditions determine when a backflow prevention assembly shall be tested:

- The assemblies shall be tested immediately after installation and before being put into operation.
- If an assembly has been relocated, or if the supply line piping is altered or changed, the assemblies shall be tested before returning service to the supply line.
The assembly shall be tested after any routine maintenance, such as cleaning, and so forth. If an assembly is repaired or overhauled, it shall be tested before returning service through the assembly.

Tests are required on any assemblies that were installed before the initiation of a formal cross connection control program.

If an assembly has a record of failure, the water purveyor may require more frequent testing or the replacement of the assembly.

5.3 TESTING PROCEDURE

General Requirement

Refer to the manufacturer's instructions and recommendations for all tests; repairs, overhauls, backflow prevention assembly replacements, and expenses are the responsibility of the customer receiving the water service. Reports on all testing and maintenance of backflow prevention assemblies shall be filed with the Orange County Utilities, Water Division.

The tester shall complete the inspection report (Appendix B) and a copy of the inspection report must be returned to the Orange County Utilities, Water Division. The purpose of the inspection report is to monitor the testing and performance of backflow prevention devices. Therefore, it is important that the required information provided be complete and accurate.

Several suggestions on testing procedures are listed below.

- The tester should notify the customer who should in turn notify its affected maintenance personnel of an impending backflow prevention assembly test.
- Notify the Orange County Utilities, Water Division if you are shutting down any water service.
- Notify the fire department if you are shutting down a fire service.
- A certified fire system contractor shall test Backflow prevention assemblies on dedicated fire lines.
- Flush residual dirt through the test cocks before attaching test gauges.
- When testing a backflow prevention device, ensure the high-and-low pressure bypass hoses of the test kit are connected to the proper test cocks; to avoid damage to the test gauges, open test cocks slowly when bleeding air through the bypass hoses.
- The test gauges should be carried in a sturdy case and be calibrated once per year as required by Orange County Utilities, Water Division.
- Backflow prevention devices shall be tested before the expiration dates of warranties.

Detailed test procedures are outlined in the Foundation for Cross Connection Control and Hydraulic Research - University of Southern California, as reported in the 9th edition of the Manual of Cross Connection Control. Adherence to these procedures is required.
Appendix A

GLOSSARY

ANSI   American National Standard Institute
ASME   American Standards of Mechanical Engineers
ASSE   American Society of Sanitary Engineering
AWWA   American Water Works Association
EPA    United States Environmental Protection Agency, Office of Water
FDEP   Florida Department of Environmental Protection
HRS    Florida Department of Health and Rehabilitative Services
NFPA   National Fire Protection Association
NIST   National Institute of Standards and Technology
OCPC   Orange County Plumbing Code (Southern Building Code Congress International, Inc.)
OCU    Orange County Utilities
OSHA   United States Department of Occupation Safety and Health Administration
USC-FCCC & HR University of Southern California, Los Angeles, Foundation for Cross-

air gap (AG)
The unobstructed vertical distance through free atmosphere between the lowest opening from any pipe or faucet conveying water or waste to a tank, plumbing fixture, receptor, or other assembly and the flood level rim of the receptacle. These vertical, physical separations must be at least twice the diameter of the water supply outlet, never less than 1 in. (25mm). Local codes and regulations may have more stringent requirements.

air gap fitting
A physical device engineered to produce an air-gap separation as defined above.

approved
Accepted by the authority responsible as meeting an applicable specification as stated or cited in the ordinance, or as suitable for the proposed use.

assembly
An assembly of one or more approved body components and including approved shutoff valves.

atmospheric pressure
The pressure exerted by the atmosphere at any point. Such pressure decreases as the elevation of the point above sea level increases. One atmosphere is equivalent to 14.7 psi (101.4 kPa), 29.92 in. (760 mm) of mercury, or 33.9 ft (10.1 m) of water column at average sea level.

atmospheric vacuum breaker (AVB)
The AVB consists of a float check, a check seat, and an air inlet port. A shutoff valve immediately upstream may be an integral part of the assembly. The AVB is designed to allow air to enter the downstream water line to prevent backsiphonage. This unit may never be subjected to a backpressure condition or have a downstream shutoff valve, or be installed where it will be in continuous operation for more than 12 hours.
GLOSSARY

auxiliary water supply
Any water supply on or available to the premises other than the purveyor’s approved public water supply. These auxiliary waters may include water from another purveyor’s public potable water supply or any natural source(s), such as a well, lake, spring, river, stream, harbor, reclaimed and so forth; or used waters or industrial fluids. These waters may be contaminated or polluted or they may be objectionable and constitute an unacceptable water source over which the Orange County Utilities Department does not have sanitary control.

backflow
The undesirable reversal of flow in a potable water distribution system as a result of a cross connection, caused by backpressure or back-siphonage.

backflow preventer
An assembly or means that prohibits the backflow of water into the potable water supply.

backpressure
A pressure, higher than the supply pressure, caused by a pump, elevated tank, boiler, air/steam pressure, or any other means which may cause backflow.

backsiphonage
Backflow caused by negative or reduced pressure in the supply piping.

bypass
Any arrangement of pipes, plumbing, or hoses designed to divert the flow around an installed device through which the flow normally passes.

certified backflow-prevention assembly tester
A person who is certified by the Orange County Building Division to test, repair, and maintain backflow-prevention assemblies.

chemical
A substance obtained by a chemical process or used for producing a chemical reaction.

consumer
The owner or operator having a service from a public potable water system.

containment (policy)
To confine potential contamination within the facility where it arises by installing a backflow prevention assembly at the meter or curb stop.

contamination
An impairment of a potable water supply by the introduction or admission of any foreign substance that degrades the quality and creates a health hazard.

critical level
A reference line representing the level of the check valve seat within a backsiphonage control unit. It is used to establish the height of the unit above the highest outlet or flood rim.

cross connection
A connection or a potential connection between any part of a potable water system and any other environment containing other substances in a manner that, under any circumstances, would allow such substances to enter the potable water system. Other substances may be gases, liquids, or solids, such as chemicals, waste products, steam, water from other sources (potable or nonpotable), or any matter that may change the color or add odors to the water.
GLOSSARY

Bypass arrangements, jumper connections, removable sections, swivel or changeover assemblies, or any other temporary or permanent connecting arrangement through which backflow may occur are considered to be cross connections.

cross connection control
The enforcement of an ordinance or other legal statement regulating cross connections.

degree of hazard
The danger posed by a particular substance or set of circumstances. Generally, a low degree of hazard is one that does not affect health, but may be aesthetically objectionable. A high degree of hazard is one that could cause serious illness or death.

direct connection
Any arrangement of pipes, fixtures, or devices connecting potable water supply directly to a nonpotable source; for example, a boiler feed line.

distribution system
All pipes, fittings, and fixtures used to convey liquid from one point to another.

double check valve assembly (DCVA)
An assembly composed of two independently acting, approved check valves, in including tightly closing resilient-seated shutoff valves located at each end of the assembly and fitting with properly located resilient-seated test cocks. This assembly shall only be used to protect against a non-health hazard (that is, a pollutant).

effective opening
The minimum cross-sectional area at the point of water supply discharge, measured or expressed in terms of the diameter of a circle, or if the opening is not circular, the diameter of a circle of equivalent cross-sectional area.

flood level rim
That level from which liquid in plumbing fixtures, appliances, or vats could overflow to the floor, when all drain and overflow openings built into the equipment are obstructed.

health hazard
A cross connection or potential cross connection involving any substance that could, if introduced into the potable water supply, cause death, illness, or spread disease, or have a high probability of causing such effects.

internal isolation
Fixture isolation and/or isolation of an area or zone. Isolation at the fixture means installing an approved backflow preventer at the source of the potential contamination. Area or zone isolation is confining the potential source of contamination within a specific area.

isolation (policy)
To confine a potential source of contamination to the nonpotable system being served; for example, to install a backflow prevention assembly on the laboratory faucet or boiler feed line.

negative pressure
Pressure that is less than atmospheric; negative pressure in a pipe can induce a partial vacuum that can siphon nonpotable liquids into the potable distribution system.

Non-health hazard
A cross connection or potential cross connection involving any substance that generally would not be a health hazard but would constitute a nuisance, or be aesthetically objectionable, if introduced into the potable water supply.
GLOSSARY

Non-potable
Any liquid that is not considered safe for human consumption.

plumbing
Any arrangement of pipes, fittings, fixtures and assemblies for the purpose of moving liquids from one point to another, generally within a single structure.

poison
A substance that can kill, injure, or impair a living organism.

pollution
The presence of any foreign substance in water that tends to degrade its quality so as to constitute a non-health hazard or impair the usefulness of the water.

potable water
Water that is safe for human consumption as described by the public health authority having jurisdiction.

premises isolation
Preventing backflow into a public water system from a user’s premises by installing a suitable backflow preventer at the user’s connection.

pressure vacuum breaker assembly (PVB)
An assembly consisting of an independently operating internally loaded check valve, an independently operating loaded air inlet valve located on the discharge side of the check valve, with properly located resilient-seated test cocks and tightly closing resilient-seated shutoff valves attached at each end of the assembly designed to operate under pressure for prolonged periods of time to prevent backsiphonage. The pressure vacuum breaker may not be subjected to any backpressure.

reclaimed water
Water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility.

reclaimed water distribution system
A network of pipes, pumping facilities, storage facilities, and appurtenances designed to convey and distribute reclaimed water from one or more domestic wastewater treatment facilities to one or more users of reclaimed water.

reduced pressure principle backflow prevention assembly (RPBA)
The approved reduced-pressure principle backflow-prevention assembly consists of two independently acting approved check valves together with a hydraulically operating, mechanically independent pressure differential relief valve located between the check valves and below the first check valve. These units are located between two tightly closing resilient-seated shutoff valves as an assembly and are equipped with properly located resilient-seated test cocks.

service connection
A piping connection between the Orange County Utilities Department main and a user’s system.

water purveyor
The owner or operator of a public, potable waterworks system.
## Appendix B
Orange County Utilities / Water Division
CERTIFIED BACKFLOW PREVENTION ASSEMBLY FIELD TEST REPORT

**Service Name:**

**Service Address:**

**City:** __________   **State:** __________   **Zip:** __________

**Account #:** __________   **Water Meter Number:** __________   **Reading:** __________

**Contractor Backflow Tester, Name (Print):**

**Company name:**

**Mailing Address:**

**City:** __________   **State:** __________   **Zip:** __________

**PSID Gauge Type:** __________   **PSID Gauge #:** __________

**Phone:** (______) __________   **Fax Number:** (______) __________

### Circle or Check Areas

**Point of Use:**

- (Containment or Isolation)
- Irrigation [ ]
- Fire [ ]
- Domestic [ ]
- Reclaimed Service [ ]

**Assembly:**

- Reduced Pressure [ ]
- Double Check [ ]
- Pressure Vacuum Breaker [ ]

**Device:**

- Existing [ ]
- New [ ]

**Mfg:** __________   **Model #:** __________   **Size:** __________   **Serial #:** __________

**Location:**

### DEVICE TEST

<table>
<thead>
<tr>
<th>CV # 1</th>
<th>CV # 2</th>
<th>Relief Valve</th>
<th>P.V.B.</th>
<th>Shut off Valves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Test</td>
<td>Closed</td>
<td>Closed</td>
<td>Opened at PSID</td>
<td>Air Inlet Opened at PSID</td>
</tr>
<tr>
<td></td>
<td>Tight</td>
<td>Tight</td>
<td>Did not Open</td>
<td>Did not open</td>
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<tr>
<td></td>
<td>Leaked</td>
<td>Leaked</td>
<td>Exercised</td>
<td>Check Valve Closed at PSID</td>
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<tr>
<td>PSID Across CK.</td>
<td>PSID Across CK.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Final Test</td>
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<tr>
<td></td>
<td>Replaced</td>
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</tr>
<tr>
<td></td>
<td>Repaired</td>
<td>Repaired</td>
<td>Repaired</td>
<td>Repaired</td>
</tr>
</tbody>
</table>

*This operational test Passed [ ] or Failed [ ]. I certify this test to be a true operational representation of the above assembly at the time and date of this test. Date: __________   Time: __________

**Print Tester's Name:**

**Tester's Signature:**

**Comments:**

Orange County's Backflow Tester Registration #: __________   Issue Date: __________

---

*Test Record must be maintained for a period of 10 years DEP-62-550.720(3)*

Mail Test to: Owner of device and Orange County Utilities, Water Division, c/o (Cross Connection Control Program)
8100 Presidents Drive, Suite C, Orlando, Florida 32809 PHONE: (407) 836-6800 FAX (407) 836-6838

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Appendix C
COMMON SYMBOLS

- **Pressure Vacuum Breaker (PVB)**
- **Backflow Prevention Assembly (RPBA)**
- **Pressure Relief Valve**
- **Pressure Reducing Valve**
- **Atmospheric Vacuum Breaker (AVB)**
- **Check Valve**
- **Ejector or Aspirator Unit**
- **Gate Valve**
- **Irrigation System**
- **Double Check Valve Assembly (DCV)**
- **Air Gap (AG)**
- **Air Gap Fitting**
- **Reduced Pressure Principle Backflow Prevention Assembly (RPBA)**
Appendix D

AMERICAN NATIONAL STANDARD
SCHEME FOR THE IDENTIFICATION OF PIPING SYSTEMS

1. OBJECT AND SCOPE

1.1 This Standard is intended to establish a common system to assist in identification of hazardous materials conveyed in piping systems and their hazards when released in the environment.

1.2 This scheme concerns identification of contents of piping systems in industrial and power plants. It is also recommended for the identification of piping systems used in commercial and institutional installations, and in buildings used for public assembly. It does not apply to pipes buried in the ground nor to electrical conduits and private homes.

1.3 Existing schemes for identification shall be considered acceptable if such schemes are described in writing and implemented so that the using facility can demonstrate that the basic concerns outlined in this Manual are being met. For example, petroleum refineries and primary chemical manufacturing plants in which hazardous work permit systems and emergency procedure manuals are utilized, wherein effective methods for the identification of pipe contents have been established, and wherein employees are trained as to the operation and hazards to the piping systems, shall be considered as meeting the requirements of this Cross Connection Program.

2. DEFINITIONS

2.1 Piping Systems
For the purpose of this Standard, piping systems shall include pipes of any kind and in addition, fittings, valves, and pipe coverings. Supports, brackets, or other accessories are specifically excluded from applications of this Standard. Pipes are defined as conduits for the transport of gases, liquids, semi-liquids, or fine particulate dust.

2.2 Materials Inherently Hazardous

2.2.1 Flammable or Explosive
This classification includes materials, which are easily ignited. It includes materials known as fire producers or those creating explosive atmosphere.

2.2.2 Chemically Active or Toxic
This classification includes materials, which are corrosive, or are in themselves toxic or productive of poisonous gases.

2.2.3 At Temperatures or Pressures
This classification includes materials which when released from the piping would have a potential for inflicting injury or property damage by burns, impingement, or flashing to vapor state.
2.2.4 Radioactive
This classification includes those materials, which emit ionizing radiation.

2.3 Materials of Inherently Low Hazard
This classification includes all materials which are not hazardous by mature, and are near enough to ambient pressure and temperature that people working on systems carrying these materials run little risk through the release of these materials.

2.4 Fire Quenching Materials
This classification includes sprinkler systems and other piped fire fighting for fire protection equipment. This includes water (for fire fighting), foam, CO₂, Halon, etc.

3. METHOD OF IDENTIFICATION

3.1 Legend
This Standard considers legend to be primary and explicit for identification of contents. Positive Identification of the contents of a piping system shall be by lettered legend giving the name of the contents in full or abbreviated form (see Table 1). Arrows shall be used to indicate direction of flow. Contents shall be identified by legend with sufficient additional details such as temperature, pressure, etc., as are necessary to identify the hazard.

Legend shall be brief, informative, pointed, and simple for greatest effectiveness. Legends shall be applied close to valves or flanges and adjacent to changes in direction, branches, and where pipes pass through walls or floors: and at intervals on straight pipe runs sufficient for identification. Identification may be accomplished by stenciling, use of tape, or markers. In any situation, the number and location of identification markers shall be based on the particular piping system.

<table>
<thead>
<tr>
<th>TABLE 1 EXAMPLES OF LEGEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>“HOT WATER”</td>
</tr>
<tr>
<td>“SLURRY”</td>
</tr>
<tr>
<td>“AIR 100 PSIG”</td>
</tr>
<tr>
<td>“ARGON 500 PSIG”</td>
</tr>
<tr>
<td>“PROPANE”</td>
</tr>
<tr>
<td>“M.P. RETURN”</td>
</tr>
</tbody>
</table>
3.2 Color
Color should be used to identify the characteristic hazards of the contents (See Table 2). Color should be displayed on, or contiguous to, the piping by any physical means, but its use shall be in combination with legend. Color may be used in continuous total length coverage or in intermittent displays.

3.3 Visibility
Attention shall be given to visibility with reference to pipe markings. Where pipelines are located above or below the normal line of vision, the lettering shall be placed below or above the horizontal centerline of the pipe.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Color Field</th>
<th>Color of Letters for Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials Inherently Hazardous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable or Explosive</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Chemically Active or Toxic</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Extreme Temperatures or Pressures</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Radioactive$^2$</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Materials of Inherently Low Hazard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or Liquid Admixture$^3$</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Gas or Gaseous Admixture</td>
<td>Blue</td>
<td>White</td>
</tr>
<tr>
<td>Fire Quenching Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water, Foam, CO$_2$, Halon, etc.</td>
<td>Red</td>
<td>White</td>
</tr>
</tbody>
</table>

Notes:
(1) When the color scheme above is used, the colors should be as recommended in ANSI 253.1 latest revision, Safety Color Code for Marking Physical Hazards.
(2) Previously specified radioactive markers using yellow and purple are acceptable if already installed and/or until existing supplies are depleted, subject to pertinent Federal Regulations.
(3) Markers with black letters on a green color field are acceptable if already installed and/or until existing supplied are depleted.
APPENDIX E
SELECTED PORTIONS OF
SECTION 608
PROTECTION OF POTABLE WATER SUPPLY

608.1 General. A potable water supply system shall be designed, installed and maintained in such a manner so as to prevent contamination from non-portable liquids, solids or gases being introduced into the potable water supply through cross-connections or any other piping connections to the system. Backflow Preventer applications shall conform to Table 608.1.

608.2 Plumbing fixtures. The supply lines or fittings for every plumbing fixture shall be installed so as to prevent backflow.

608.3 Devices, appurtenances, appliances and apparatus. All devices, appurtenances, appliances and apparatus intended to serve some special function, such as sterilization, distillation, processing, cooling, or storage of ice or foods, and that connect to the water supply system, shall be provided with protection against backflow and contamination of the water supply system. Water pumps, filters, softeners, tanks, commercial drinking water dispensers, and all other appliances and devices that handle or treat potable water shall be protected against contamination.

608.4 Water service piping. Water service piping shall be protected in accordance with Sections 603.2 and 603.2.1.

608.5 Chemicals and other substances. Chemicals and other substances that produce either toxic conditions, taste, odor or discoloration in a potable water system shall not be introduce into, or utilized in, such system.

608.6 Cross-connection control. Cross-connection shall be prohibited, except where approved protective devices are installed.

608.6.1 Private water supplies. Cross-connections between a private water supply and a potable public supplies shall be prohibited.

608.8 Identification of potable and non-portable water. In all buildings where two or more water distribution systems, one portable water and the other non-portable water, are installed, each system shall be identified either by color marking or metal tags are required by ASME A13.1. Reclaimed water systems shall be identified using color coded Pantone Purple 522 C and marked with the statement “Non-portable water- not for human consumption.”

608.10 Reuse of piping. Piping that has been utilized for any purpose other than conveying portable water shall not be utilized for conveying potable water.

608.13 Backflow protection. Means of protection against backflow shall be provided in accordance with Sections 608.13.1 through 608.13.7.

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>DEGREE OF HAZARD</th>
<th>APPLICATION</th>
<th>APPLICABLE STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Gap</td>
<td>High or low hazard</td>
<td>Back-siphonage or back pressure</td>
<td>ASME A112.1.2</td>
</tr>
<tr>
<td>Reduced Pressure Assembly Backflow Preventer</td>
<td>High or Low hazard</td>
<td>Back-pressure or back-siphonage Size 3/8” –16”</td>
<td>ASSE 1013 AWWA C511 CSA CAN/CSA-B64.4</td>
</tr>
<tr>
<td>Description</td>
<td>Hazard Level</td>
<td>Description</td>
<td>Manufacturer</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Reduced Pressure Detector Assembly Backflow Preventer</td>
<td>High or Low</td>
<td>Back-siphonage or back-pressure (Fire sprinkler systems)</td>
<td>ASSE 1047</td>
</tr>
<tr>
<td>Double Check Backflow Prevention Assembly</td>
<td>Low Hazard</td>
<td>Back-pressure or back-siphonage Sizes 3/8” – 16”</td>
<td>ASSE 1015</td>
</tr>
<tr>
<td>Double Check Detector Assembly Backflow Preventer</td>
<td>Low Hazard</td>
<td>Back-pressure or Back-siphonage (Fire sprinkler systems) Size 1 ½” – 16”</td>
<td>ASSE 1048</td>
</tr>
<tr>
<td>Pressure Vacuum Breaker Assembly</td>
<td>High or Low</td>
<td>Back-siphonage only Sizes ½” – 2”</td>
<td>ASSE 1020</td>
</tr>
<tr>
<td>Hose-connection Vacuum Breaker</td>
<td>High or Low</td>
<td>Low head back-pressure or back-siphonage Sizes ½”, 3/4” – 1”</td>
<td>ASSE 1011</td>
</tr>
<tr>
<td>Spill-proof vacuum breaker</td>
<td>High or Low</td>
<td>Back-siphonage only Sizes ¼” – 2”</td>
<td>ASSE 1056</td>
</tr>
</tbody>
</table>

### 608.14 Location of backflow Preventer.
Access shall be provided to backflow Preventer as specified by the installation instruction of the approved manufacturer.

### 608.15 Protection of potable water outlets.
All potables water openings and outlets shall be protected against backflow in accordance with Section 608.15.1, Section 608.15.2, Section 608.15.3, Section 608.15.4, Section 608.15.4.1 or Section 608.15.4.2.

### 608.15.4.2 Hose connections.
Sill-cocks, hose bibs, wall hydrants and other openings with a hose connection shall be protected by an atmospheric-type or pressure-type vacuum breaker or a permanently attached hose connection vacuum breaker.

### 608.16 Connection to the potable water system.
Connections to the portable water system shall conform to Sections 608.16 through 608.16.9.

### 608.16.4 Connections to automatic fire sprinkle system and standpipe systems.
The potable water supply to automatic fire sprinkler and standpipe systems shall be protected against backflow by a double check-valve assembly or a reduced pressure principle backflow preventer.

#### Exceptions:

1. Where systems are installed as a portion of the water distribution system in accordance with the requirements of this code and are not provided with a fire department connection, isolation of the water supply system shall not be required.

2. Isolation of the water distribution system is not required for deluge, pre-action or dry pipe systems.
608.16.4.1 Additives or non-potable source. Where systems contain chemical additives or anti-freeze, or where systems are connected to a non-potable secondary water supply, the potable water supply shall be protected against backflow by a reduced pressured principle backflow preventer. Where chemical additives or anti-freeze are added to only a portion of an automatic fire sprinkler or standpipe system, the reduced pressure principle backflow preventer shall be permitted to be located so as to isolate that portion of the system.

608.16.5 Connections to lawn irrigation systems. The portable water supply to lawn irrigation systems shall be protected against backflow by an atmospheric-type vacuum breaker, a pressure-type vacuum breaker or a reduced pressure principle backflow preventer. A valve shall not be installed downstream from an atmospheric vacuum breaker. Where chemicals are introduced into the system, the potable water supply shall be protected against backflow by a reduced pressure principle backflow preventer.

608.16.6 Connections subject to back pressure. Where a potable water connection is made to a non-portable line, fixture, tank, vat, pump or other equipment subject to back pressure, the portable water connection shall be protected by a reduced pressure principle backflow preventer.

608.16.7 Chemical dispensers. Where chemical dispensers connect to the water distribution system, the water supply system shall be protected against backflow in accordance with Section 608.13.1, Section 608.13.2, Section 608.13.3, Section 608.13.5, Section 608.13.6 or Section 608.13.8.

608.16.8 Portable cleaning equipment. Where the portable cleaning equipment connects to the water distribution system, the water supply system shall be protected against backflow in accordance with Section 608.13.1, Section 608.13.2, Section 608.13.3, Section 608.13.7 or Section 608.13.8.

SELECTED PORTIONS OF SECTION 312 TESTING AND INSPECTIONS

312.9 Inspection and testing of backflow prevention assemblies. Inspections shall be made of all backflow prevention assemblies to determine whether they are operable. Reduced pressure principle backflow preventer assemblies, double check-valve assemblies, double-detector check-valve assemblies and pressure vacuum breaker assemblies shall be tested. The frequency of testing shall be determined in accordance with the manufacturer’s installation instructions. Where the manufacturer of the assembly does not specify the frequency of testing, the assembly shall be tested at least annually.
Appendix F

DRINKING WATER STANDARDS, MONITORING, AND REPORTING
PART III: QUALITY STANDARDS


The ultimate concern of a public drinking water program is the quality of piped water for human consumption when the water reaches the consumers. The following rules establish the maximum contaminant levels for the water within public water systems. Public water systems shall not exceed the maximum contaminant levels established herein unless granted a variance or exemption pursuant to Rules 62-560.510 or 62-560.520, F.A.C., or identified as excluded from the standards by this chapter. Public water systems shall take necessary corrective action approved by the Department to meet all applicable standards. Treatment techniques in lieu of maximum contaminant levels for surface water systems or ground water systems under the direct influence of surface water are referenced in Rule 62-555.600, F.A.C., Scope of Additional Requirements for Surface Water Systems.

Specific Authority: 403.861(9), F.S.
Law Implemented: 403.852(12),(13), 403.853(1), F.S.


(These standards may also apply as ground water quality standards as referenced in Chapter 62-520, F.A.C.)

(1) INORGANICS. Except for nitrate and nitrite, which apply to all public water systems, this subsection applies to community water systems and non-transient non-community water systems only.

(a) The maximum contaminant levels for the inorganic contaminants are listed in 4 Table 1, which is incorporated herein and appears at the end of this chapter.
(b) The maximum contaminant level for nitrate (as N) applicable to non-community water systems is 10 milligrams per liter. The Department or Approved County Health Unit shall allow a contaminant level for nitrate (as N) of up to 20 milligrams per liter upon a showing by the supplier of water that the following conditions are met:
   1. The water distributed by the water system is not available to children under 6 months of age or to lactating mothers, and
   2. There is continuous public notification of what the nitrate level (as N) is and what the potential health effects of such exposure are.
   3. The Department shall require monitoring every 3 months as long as the maximum contaminant level is exceeded. Should adverse health effects occur, the Department shall require immediate compliance with the maximum contaminant level for nitrate (as N).
(2) ORGANICS. Paragraph (a) below applies only to community water systems serving more than 10,000 people. Paragraphs (b) and (c) apply to community and non-transient non-community water systems. Paragraph (d) applies to all public water systems that use acrylamide or epichlorohydrin in their water systems.

(a) Total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromof orm) and trichloromethane (chloroform)). The maximum contaminant level is 0.10 milligrams per liter (mg/L).

(b) The maximum contaminant levels for the volatile organic compounds are listed in 4 Table 2 which is incorporated herein and appears at the end of this chapter.

(c) The maximum contaminant levels for the pesticides and polychlorinated biphenyls (PCBs) are listed in 4 Table 3 which is incorporated herein and appears at the end of this chapter.

(d) There are no maximum contaminant levels for the water treatment chemicals acrylamide and epichlorohydrin. However, treatment techniques pursuant to Rule 62-550.325, F.A.C., shall apply.

(3) MICROBIOLOGICAL. This subsection applies to all public water systems. Monitoring requirements to demonstrate compliance with this subsection are defined in Rule 62-550.518, F.A.C.

(a) The maximum contaminant level is based on the presence or absence of total coliforms in a sample, rather than coliform density. For the purposes of the public notice requirements in Rule 62-560.410, F.A.C., a violation of the standards in this paragraph poses a non-acute risk to health.

1. For a system which collects at least 40 samples per month, if no more than 5.0 percent of the samples collected during a month are total coliform-positive, the system is in compliance with the maximum contaminant level for total coliforms.

2. For a system which collects fewer than 40 samples per month, if no more than one sample collected during a month is total coliform-positive, the system is in compliance with the maximum contaminant level for total coliforms.

(b) Any fecal coliform-positive repeat sample or E. coli-positive repeat sample, or any total coliform-positive repeat sample following a fecal coliform-positive or E.coli-positive routine sample is a violation of the maximum contaminant level for total coliforms. For the purposes of the public notification requirements in Rule 62-560.410, F.A.C., this is a violation that poses an acute risk to health.

(c) A public water system shall determine compliance with the maximum contaminant level for total coliforms in Paragraphs (a) and (b) of this subsection for each month (or quarter for non-community water systems which serve 1,000 or fewer persons) in which it is required to monitor for total coliforms.

(3) RADIONUCLIDES. This subsection applies only to community water systems and non-transient non-community water systems. The following are maximum contaminant levels for:
DRINKING WATER STANDARDS, MONITORING, AND REPORTING
PART III: QUALITY STANDARDS

(a) Naturally occurring radionuclides:

<table>
<thead>
<tr>
<th>Contaminant Level</th>
<th>picocuries per liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined radium-226 and radium-228</td>
<td>5</td>
</tr>
<tr>
<td>Gross alpha particle activity including radium-226 but excluding radon and uranium</td>
<td>15</td>
</tr>
</tbody>
</table>

(b) Man-made radionuclides:
1. The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce a total annual exposure greater than 4 millirem/year.
2. Except for those radionuclides listed below, the concentration of radionuclides in Subparagraph 1. shall be calculated on the basis of a 2 liter per day drinking water intake using the 168-hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. Average Annual Concentration Assumed to Produce an Exposure of 4 millirem/year: Tritium in the total body - 20,000 pCi/l Strontium-90 in the bone marrow - 8 pCi/l.

Specific Authority: 403.861(9), F.S.
Law Implemented: 403.852(12), 403.853(1), F.S.
History: New 11-19-87, Formerly 17-22.210, Amended 1-18-89, 5-7-90, 1-3-91, 1-1-93, 1-26-93, 7-4-93, Formerly 17-550.310, Amended 9-7-94.

This section applies only to community water systems. (These standards may also apply as ground water quality standards as referenced in Chapter 62-520, F.A.C.)

(1) The secondary maximum contaminant levels are listed in 4 Table 4 which is incorporated herein and appears at the end of this chapter.

(2) Failure to meet the fluoride secondary standard requires public notification pursuant to Rule 62-560.430, F.A.C.

Specific Authority: 403.861(9), F.S.
Law Implemented: 403.852(13), 403.853(1), F.S.
History: New 11-19-87, Formerly 17-22.220, Amended 1-18-89, 1-1-93, 7-4-93, Formerly 17-550.320, Amended 9-7-94

62-550.325 Treatment Techniques.
This section establishes treatment techniques that may be used by suppliers of water in lieu of complying with maximum contaminant levels for specified contaminants.
(1) The following treatment technique for acrylamide and epichlorohydrin shall be used in lieu of maximum contaminant levels:
   (a) Each public water system shall certify annually in writing to the Department (using third party or manufacturer's certification) that when acrylamide and epichlorohydrin are used, the combination of dose and monomer level does not exceed the levels specified as follows:
      1. Acrylamide 0.05 percent dosed at 1 ppm (or equivalent).
      2. Epichlorohydrin 0.01 percent dosed at 20 ppm (or equivalent).
   (b) Certifications may rely on manufacturers or third parties, as approved by the Department.

(2) Iron and Manganese.
   (a) Suppliers of water may use sequestering agents in lieu of meeting the maximum contaminant level for iron and manganese when the maximum iron and manganese concentration does not exceed 1.0 milligrams per liter in water.
   (b) Such agents or additives and their proposed dosage rate shall be approved for potable water use pursuant to Rule 62-555.320(3), F.A.C.
   (c) Suppliers of water shall report the dosage rate and water concentration level of the sequestering agent in treated water to the Department annually in writing.

Specific Authority: 403.861(6),(9), F.S.
Law Implemented: 403.853(1),(3), 403.854(1), 403.861(16),(17), F.S.
History: New 1-1-93, Amended 7-4-93, Formerly 17-550.325.

   No contaminant which creates or has the potential to create an imminent and substantial danger to the public shall be introduced into a public water system.

Specific Authority: 403.861(9), F.S.
Law Implemented: 403.852(12),(13), 403.853(1), F.S.

   All contaminants having a maximum contaminant level established by Chapter 62-550, Part III, F.A.C., shall be sampled in accordance with Chapter 62-550, Part V, F.A.C., and analyzed in accordance with the methods applicable to drinking water contained in Chapter 10D-41, F.A.C.

Specific Authority: 403.861(9), F.S.
Law Implemented: 403.852(12),(13), 403.853(1), F.S.
Appendix G

PERMITTING AND CONSTRUCTION OF PUBLIC WATER SYSTEMS
PART III: CONSTRUCTION, OPERATION, AND MAINTENANCE

(1) Cross-connection, as defined in Rule 62-550.200, F.A.C. is prohibited. However, a person who owns or manages a public water system may interconnect to another public water system if that system is operated and maintained in accordance with this chapter.
(2) Community water systems, and all public water systems which have service areas that are also served by reclaimed water systems as defined in Chapter 62-610, Part III, F.A.C., shall establish a routine cross-connection control program to detect and prevent cross-connections that create or may create an imminent and substantial danger to public health. This program shall include a written plan that is developed using accepted practices of the American Water Works Association as set forth in the reference documents cited in Rules 62-555.330(6) and (7), F.A.C.
(3) Upon discovery of a prohibited cross-connection, public water systems shall either eliminate the cross-connection by installation of an appropriate backflow prevention device acceptable to the Department or shall discontinue service until the contaminant source is eliminated.
(4) Only the following are considered to be backflow prevention devices. They shall be installed in agreement with and under the supervision of the supplier of water or his designated representative (plumbing inspector, etc.) at the consumer's meter, at the property line of the consumer when a meter is not used, or at a location designated by the supplier of water or the Department. The devices are:
   (a) Air gap separation - A physical separation between the free-flowing discharge end of a potable water supply pipeline and an open or non-pressure receiving vessel. An "approved air gap separation" shall be at least double the diameter of the supply pipe measured vertically above the top of the rim of the vessel. In no case shall it be less than 1 inch.
   (b) Reduced pressure backflow preventer - A device containing within its structure a minimum of two independently acting approved check valves, together with an automatically operating pressure differential relief valve located between the two check valves. The first check valve reduces the supply pressure a predetermined amount so that during normal flow and at cessation of normal flow the pressure between the checks shall be less than the supply pressure. In case of leakage of either check valve, the differential relief valve, by discharging to the atmosphere, shall operate to maintain the pressure between the checks less than the supply pressure. The unit shall include tightly closing shutoff valves located at each end of the device, and each device shall be fitted with properly located test cocks.
   (c) Atmospheric vacuum breaker - A backflow prevention device which is operated by atmospheric pressure in combination with the force of gravity. The unit is designed to work on a vertical plane only. The one moving part consists of a poppet valve which must be carefully sized to slide in a guided chamber and effectively shut off the reverse flow of water when a negative pressure exists.
(d) Pressure vacuum breaker - A pressure vacuum breaker is similar to an atmospheric vacuum breaker except that the checking unit poppet valve is activated by a spring. This type of vacuum breaker does not require a negative pressure to react and can be used on the pressure side of a valve.

(e) Double check valve assembly - An assembly composed of two single, independently acting, check valves, including tightly closing shutoff valves located at each end of the assembly and suitable connections for testing the water tightness of each check valve. A check valve is a valve that is drip-tight in the normal direction of flow when the inlet pressure is one psi and the outlet pressure is zero. The check valve shall permit no leakage in a direction reverse to the normal flow. The closure element (e.g., clapper) shall be internally weighted or otherwise internally loaded to promote rapid and positive closure.

(f) Residential dual check - A compact unit manufactured with two independent spring actuated check valves. The residential dual check is acceptable only as added backflow prevention in areas served by reuse systems defined in Chapter 62-610, Part III, F.A.C., when the cross-connection control program identifies activities specific to (5)(a) and (5)(b) of this section.

(5) Cross-connection control programs specific to reuse systems defined in Chapter 62-610, Part III, F.A.C., shall consider the following:
   (a) Enhanced public education efforts towards prevention of cross-connections.
   (b) Enhanced inspection programs for portions of the distribution system in areas of reuse for detection and elimination of cross-connections.
   (c) Dual check valves shall be considered acceptable for reducing risks from backflow only at residential properties served by reclaimed water unless:
       1. Local codes, ordinances, or regulations require greater levels of backflow prevention.
       2. Other hazards exist on the property that require a greater level of backflow prevention.

Specific Authority: 403.861(9), F.S.
Law Implemented: 403.861(9), F.S.
Appendix H

REUSE OF RECLAIMED WATER AND LAND APPLICATION
PART VII: INDUSTRIAL USES OF RECLAIMED WATER

62-610.658 Access Control and Advisory Signs.
(1) For all systems, advisory signs shall be posted around the portions of the industrial site in which reclaimed water is used and at the main entrances to the industrial site to notify employees at the industrial site and the public of the nature of the reclaimed water use.
(2) Access control beyond what is normally provided by the industry is not required.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 1-9-96.

62-610.661 (1) No cross-connections to potable water systems shall be allowed.
(2) For all systems, there shall be readily identifiable "non-potable" or "do not drink" notices, marking, or coding on application/distribution facilities and appurtenances.
(3) Protection of Reclaimed Water Supply.
   (a) The return of reclaimed water to the reclaimed water distribution system after the reclaimed water has been delivered to an industrial facility is prohibited. This prohibition shall not apply to industrial sites which were using reclaimed water before January 1, 1996, or which were identified as future users of reclaimed water in a complete permit application received by the Department before January 1, 1996.
   (b) The permittee shall conduct an evaluation of the potential for cross-connections and backflow to the reclaimed water distribution system. This analysis shall include an evaluation of the types of substances present at the industrial site which could potentially backflow into the reclaimed water system and the risk associated with possible backflow. The applicant shall evaluate the need for backflow prevention devices on the reclaimed water connection to the industrial facility. This analysis shall be included in the engineering report. A backflow prevention device shall be provided on the reclaimed water service connection to the industrial site, unless the evaluation in the engineering report provides reasonable assurances that there is minimal risk of cross-connection or backflow with contamination of the reclaimed water supply.
   This requirement for backflow prevention devices shall not apply to industrial sites which were using reclaimed water before January 1, 1996 or which were identified as future users of reclaimed water in a complete permit application received by the Department before January 1, 1996.

Specific Authority: 403.061, 403.087, F.S.
Law Implemented: 403.021, 403.061, 403.062, 403.085, 403.086, 403.087, 403.088, F.S.
History: New 4-4-89, Amended 4-2-90, Formerly 17-610.660, Amended 1-9-96.
PART I  APPLICATION PROCEDURES
4A-46.001 Scope
The provisions of this part shall apply to those individuals wishing to be qualified by the State Fire Marshal as a contractor of fire protection systems in this state pursuant to the provisions of Section 633.521, Florida Statutes.

Specific Authority : 633.01, 633.517 (1) F.S.
History : New 10-14-86.

4A-46.005 Definitions.
For purposes of this part, the following terms shall have the following meanings:
(1) “Contractor” shall mean a “Contractor I, II, III, IV, or V” as defined in Section 633.021 (5)(a)-(e), Florida Statutes.
(2) “Fire Protection System” shall mean a system as defined in Section 633.021(7), Florida Statutes.
(3) “Employed by” shall mean that point at which a person earns compensation, directly or indirectly, from a contractor.
(4) “Point-of-service” shall mean that point as defined in Section 633.521(16), Florida Statutes.
(5) “Sprinkler System” shall mean that system as defined in Section 633.021(20), Florida Statutes.

Specific Authority : 633.01, 633.517(1) F.S.
Law Implemented : 633.021(5), (7), (16), (20), 633.521 F.S.
History : New 10-14-86, Amended 12-21-88

4A-46.010 Submission of the Application.
(1) The applicant shall submit an application on a form furnished by the division which shall conform with Section 633.534, Florida Statutes.
(2) The application shall be accompanied by a fee as prescribed in Section 633.524, Florida Statutes.
(3) (a) As a prerequisite to challenging the examination as a Contractor I, II, or III, the applicant shall provide evidence of four (4) years proven experience in the employment of a Contractor I, II, or III, or a combination of experience and education equivalent thereto.
   1. “Experience in the employment of a contractor”, as required by Section 633.521(3), Florida Statutes, must be gained from full-time employment by a contractor, such employment relating to technical areas. For purposes of this rule chapter, “technical areas” means those activities engaged in by a contractor and participated in by the applicant which provide experience in laying out, fabricating, installing, inspecting, altering, repairing, or servicing fire protection systems. For purposes of this rule chapter, four (4) years proven experience as a certified plumbing contractor, licensed pursuant to the provisions of Chapter 489, Florida Statutes, may be offered toward the experience requirements for a Contractor I or II and shall be considered equivalent to two (2) years proven experience in the employment of a contractor. A certified plumbing contractor shall offer no more than 4 years as a certified plumbing contractor toward the 4 years experience requirement in Section 633.521, Florida Statutes. The applicant’s experience must be verified by the contractor employing the applicant. The required verification shall be in the form of a letter from the employer, on company stationery, describing the applicant’s duties, the kinds of jobs he worked on; his dates of employment; and any other information reasonably calculated to provide the division with an informed understanding of the applicant’s work experience. An applicant offering self-employment experience shall provide verification in the form of letters from customers, and others familiar with his work. It is the applicant’s responsibility to furnish the required verification. The experience will be evaluated to determine an applicant’s qualifications for the class of certificate requested; or,
CHAPTER 4A-46, F.A.C.
FIRE PROTECTION CONTRACTORS AND SYSTEMS
PART I APPLICATION PROCEDURES

2. The division will accept a current NICET Level III or IV certification as a Fire Protection Engineering Technician in the subfield of Automatic Sprinkler System Layout, for contractor I and II applicants, and will accept a current NICET Level III or IV certification as a Fire Protection Engineering Technician in the subfield of Special Hazards System Layout, for Contractor III applicants, issued by the National Institute for Certification in Engineering technologies in Alexandria, Virginia; or,

3. The applicant can provide evidence of a combination of experience and education equivalent to four (4) years proven experience in the employment of a contractor. Acceptable education shall include, but not be limited to, a bachelor degree from a four (4) year college or university with a major in mechanical engineering, civil engineering, fire science engineering technology, or equivalent coursework; or an associate degree (2 years) with a major in fire science engineering technology or fire protection engineering technology. The applicant must furnish official transcripts to substantiate all degrees and coursework. The curriculum, degree, date degree awarded, and all engineering, fire science, and fire protection courses must be clearly identified on the transcripts. Acceptable experience to combine with the education offered shall be provided in the same form as required under subparagraph 1., above. For purposes of combining education and work experience, the number of hours worked in part-time employment will be counted as the appropriate percentage of full-time employment.

4. a. Applicants for certification as a Contractor I who are offering 4 years proven experience as a certified plumbing contractor as the equivalent of 2 years proven experience in the employment of a contractor shall combine that experience with a NICET Level III or IV certificate; or with 18 credit hours from a 4-year college or university, or a junior or community college in courses which teach the material in the National Fire Protection Association standards on which the applicant will be tested; or with other equivalent coursework.

   b. Applicants for certification as a Contractor II who are offering 4 years proven experience as a certified plumbing contractor as the equivalent of 2 years proven experience in the employment of a contractor shall combine that experience with a NICET Level III or IV certificate; or with 15 credit hours from a 4-year college or university, or a junior or community college in courses which teach the material in the National Fire Protection Association standards on which the applicant will be tested; or with other equivalent coursework.

   (b) As a prerequisite to challenging the examination as a Contractor IV, the applicant shall provide evidence of two (2) years proven experience in the employment of a Contractor I, II, or IV, or a combination of equivalent education and experience, which combination need not include experience in the employment of a contractor.
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For purposes of combining education and experience, education in the areas described in paragraph (a) 3., above, including at least 3 credit hours from a 4-year college or university or junior or community college in courses which teach the material in the National Fire Protection Association standards on which the applicant will be tested; or other equivalent coursework; and experience in the areas described in paragraph (a) 1., above, shall be provided. In addition, the division will accept a current NICET Level III or IV Certification as a Fire Protection Engineering Technician in the subfield of Automatic Sprinkler System Layout, issued by the National Institute for Certification in Engineering Technologies in Alexandria, Virginia.

(c) As a prerequisite to challenging the examination as a Contractor V, the applicant shall provide evidence of:

1. licensing as a certified underground utility contractor, pursuant to the provisions of chapter 489, Florida Statutes, which shall be submitted in the form of a copy of the license issued by the Department of Business and Professional Regulation, accompanied by a statement that the applicant certifies that he is the person named on the license; or

2. employment by an individual licensed as a certified underground utility contractor pursuant to the provisions of Chapter 489, Florida Statutes, that the applicant has four (4) years experience in the employment of a certified underground utility contractor, which shall be submitted in the form of a letter, on company stationery, signed by the certified underground utility contractor, describing the applicant’s duties; the kinds of jobs he worked on; his dates of employment; and any other information reasonably calculated to provide the division with an informed understanding of the applicant’s work experience; or

3. A combination of education and experience equivalent to four (4) years proven experience in the employment of a certified underground utility contractor. For purposes of combining education and experience, the education in the areas described in paragraph (a)3., above, including at least 3 credit hours from a 4-year college or university or junior or community college in courses which teach the material in the National Fire Protection Association standards on which the applicant will be tested; or other equivalent coursework; and experience in the areas described in paragraphs (a)1., or (c)1., or 2., above, shall be provided.

(d) For all classes of contractor applicants the division will accept other experience and education combinations which are equivalent to those described above.

(4) The applicant shall not be approved to challenge a competency examination unless the applicant has substantiated employment experience or a combination of employment and education. The applicant is encouraged to submit documentation of all relevant experience and education since each instance of a combination prerequisite must necessarily be decided individually. When the review of the application has been completed the applicant will be notified in writing whether or not he has qualified to challenge the competency examination in accordance with the provisions of Chapter 120, Florida Statutes.
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Specific Authority: 633.01, 633.517(1) F.S.
History: New 10-14-86, Amended 12-21-88, 10-20-93

4A-46.015 Testing.

(1) An applicant who has been qualified to challenge an examination will be notified in writing of available examination dates at a division district office. Upon receipt of a written request for a specific examination date, the applicant will be sent a notice of the exam date, time and location at least seven days prior to the scheduled exam. The applicant will be expected to challenge the exam on that day unless he submits a written waiver of his right to challenge the exam on that day and requests a later date. The Regulatory License and Statistics Section will schedule an applicant for a later day upon receipt of a written request. The applicant will also be permitted to challenge the examination at the Regulatory Licensing and Statistics Section’s office in Tallahassee if the applicant makes a request for such testing in writing and receives written notification when the next available scheduled examination will be held in Tallahassee.

(2) The examinations are multiple choice and open book. The examinations are based on relevant Florida and federal laws pertaining to the construction industry, safety standards, administrative procedures, pertinent technical data, and on standards of the National Fire Protection Association (NFPA). An applicant shall be notified of the study material required for the contractor class for which he has applied.

(3) Each applicant must provide his or her own NFPA standards and other resource materials for use during the exam. Applicants will not be allowed to share standards or materials during an examination.

(4) NFPA standards may be obtained from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02215. Sources for other materials will be listed on the information sheet supplied to each applicant before the examination.

(5) The applicant must bring positive identification, including identification containing the applicant’s photograph, to the exam.

(6) Examination grades and papers are confidential. Applicants will be notified of examination scores in writing only.

(7) Reexaminations will be scheduled no sooner than 30 days after any administration of an examination to an applicant. Each examination scheduled requires an examination fee as provided in Section 633.524, Florida Statutes.

(8) Upon successful completion of a competency examination an applicant must submit evidence of insurance coverage meeting the requirements of Section 633.521, Florida Statutes.

(9) Upon satisfactory completion of the application, testing and insurance requirements, a certificate will be issued.
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PART I APPLICATION PROCEDURES

Specific Authority: 633.01, 633.517(1) F.S.
Law Implemented: 633.521 F.S.
History: New 10-14-86, Amended 12-21-88, 8-1-90, 10-20-93, 10-2-96, 6-8-98.

4A-46.016 Insurance Requirements.
(1) The Fire Protection System Contractor I, II, III, IV, or V licensed pursuant to Section 633.521, Florida Statutes, shall provide evidence of current and subsisting insurance coverage meeting the requirements of Section 633.521, Florida Statutes, to the State Fire Marshal on Form D14A-25, Certificate of Insurance Fire Protection System Contractor, revised and dated 8/93, as adopted and incorporated herein by reference. This form is available from the Regulatory Licensing and Statistics Section, Bureau of Fire Prevention, 200 East Gaines Street, Tallahassee, FL, 32399-0300.
(2) The licensed Fire Protection System Contractor I, II, III, IV, or V shall be responsible to ensure current and subsisting insurance coverage meeting the requirements of Section 633.521, Florida Statutes, is on file with the State Fire Marshal.
(3) Failure to provide evidence of insurance coverage within 30 days of the expiration date of the policy or within 30 days of a notice to provide evidence of coverage shall result in administrative proceedings pursuant to Section 633.547, Florida Statutes.

Specific Authority: 633.01, 633.517(1), 633.521(4) F.S.
Law Implemented: 633.521(4) F.S.
History: New 10-20-93

4A-46.017 Required Continuing Education.
(1) Certificate holders shall complete a continuing education course or combination of courses in compliance with Section 633.537, Florida Statutes, within each license year which begins July 1 and expires June 30.
(2) The continuing education course or combination of courses shall be in fire protection discipline. This course or combination of courses shall be a total of 24 contact hours in duration.
(3) The course or combination of courses shall be conducted by persons approved by the Division. Approval of such persons shall be based on the person’s training, experience and expertise in fire protection under Florida law.
(4) Written instructional materials and any audio-visual aids must provide instruction relevant to fire protection under Florida law.
(5) The course or combination of courses shall be approved by the Division. The Division shall approve any course, seminar, or conference in the technical areas provided by any university, community college, vocational-technical center, public or private school, firm, association, person, corporation or entity which meets the criteria provided in this rule.
(6) Courses shall be submitted for approval for credit toward the continuing education requirement.
(a) Requests for approval shall be submitted on Form D14-1239 (6/97), “Request for Approval of Fire Protection System Contractor Continuing Education Coursework” as adopted and incorporated herein by reference.

(b) Forms are available from and submissions shall be sent to: Regulatory Licensing and Statistics Section, 200 East Gaines Street, Tallahassee, Florida, 32399-0342.

(c) Each certificate holder shall be notified by the Regulatory Licensing and Statistics Section, in writing if the coursework does not satisfy the continuing education requirement in Section 633.537, Florida Statutes. No notification will be given over the telephone.

(d) The application shall include:

1. the total number of classroom hours,
2. the course outline of the contents of the course,
3. the name and qualification of instructors,
4. a written description of any audio-visual aids,

and

5. a copy of any instructional materials or handouts must be attached.

(e) The number of classroom hours must be devoted to course content and does not include registration periods, meals, and keynote speakers or similar nonsubstantive time periods.

(f) Examples of courses which will be approved if the criteria and procedures of this rule are met:

1. Florida Fire Sprinkler Association meetings;
2. American Fire Sprinkler Association meetings;
3. NFPA meetings and seminars; and
4. training sessions conducted by manufacturers.

(g) The division shall approve continuing education courses which relate to the technical fire protection skills of certificate holders which contain educational content to improve the quality of a contractor’s fire protection performance.

(h) At the conclusion of each approved course, the organization or person offering the course shall inform the Division that the course was completed and shall supply the Division with sign-in sheet or roster. The sign-in sheet or roster shall require every person to print their name, list their contractor’s certificate number and sign their name.

(i) Each person who completes an approved course shall be issued a certificate of completion. The certificate of completion shall contain the name and license number of the person who completed the course. The certificate shall include the name of the course and the course number assigned by the division.

(7) Each certificate holder is responsible for attending the appropriate course or courses and for maintaining proof of completion of the course or courses. Such proof shall be in the form of copies of certificates of completion awarded. The Regulatory Licensing and Statistics Section will not accept any proof of completion except that submitted in accordance with subsection (8) below.
(8) Prior to the annual expiration of the Certificate of Competency, the certificate holder shall submit proof of completion of the required course or courses to the Regulatory Licensing and Statistics Section. Submissions shall be submitted on a “Fire Protection System Contractor Continuing Education Coursework” form, D14-1240 (8/96) as adopted and incorporated herein by reference. Forms are available from and submissions shall be sent to: Regulatory Licensing and Statistics Section, 200 East Gaines Street, Tallahassee, Florida, 32399-0342. Each certificate holder will be notified by the Regulatory Licensing and Statistics Section, in writing, if the coursework does not satisfy the continuing education requirement in Section 633.537, Florida Statutes. No notification will be given over the telephone.

(9) Any Fire Protection System Contractor who does not complete the continuing education requirement shall not have his or her certificate renewed. If the certificate holder is not renewed, the certificate holder shall perform no work for which a license is required. A certificate holder wishing to become licensed again shall meet the requirements of Section 633.521, Florida Statutes.

Specific Authority : 633.01, 633.517(1) F.S.
Law Implemented : 633.521, 633.537 F.S.
History : New 10-2-96, Amended 6-18-97,6-8-98.
PART II GENERAL PROVISIONS

4A-46.025 Scope.

The provisions of this part shall apply to the layout, fabrication, installation, inspection, alteration, repair, or servicing on the fire protection systems.

Specific Authority: 633.01 F.S.
History: New 12-21-88.

4A-46.030 Definitions.

(1) For purposes of this part, the definitions in Rule 4A-46.005 shall have the same meaning as in Part I.
(2) In addition, the following term shall have the following meaning: “Registered professional engineer” shall mean an individual who is registered to engage in the practice of engineering as prescribed in Chapter 471, Florida Statutes.

Specific Authority: 633.01 F.S.
Law Implemented: 633.021 F.S.
History: New 12-21-88, Amended 8-1-90.

4A-46.035 Standards of the National Fire Protection Association to be Complied With.

(1) The following standards of the National Fire Protection Association which are hereby adopted and incorporated herein by reference shall be complied with by all those holding certificates of competency as fire protection system contractors pursuant to the provisions of Chapter 633, Florida Statutes:
CHAPTER 4A-46, F.A.C.
FIRE PROTECTION CONTRACTORS AND SYSTEMS
PART II GENERAL PROVISIONS


Specific Authority : 633.01 F.S.
Law Implemented : 633.01, 633.051, 633.065, 633.082 F.S.
History : New 12-21-88 Amended 7-19-89, Amended 8-1-90, 10-2-93, 10-2-96, 6-8-98.

4A-46.040 Installation Requirements for Automatic Sprinkler Systems Employing Water as the Extinguishing Agent.

(1) Fire protection system contractors installing an automatic sprinkler system employing water as the existing agent shall supervise and be responsible for the complete system, except that a Contractor installing the underground pipe shall supervise and be responsible only for the portion he installs and the Contractor installing the remaining portion of the system shall be responsible only for his portion of the work.

The contractor shall be responsible to install the complete system in compliance with the National Fire Protection Association standards adopted pursuant to Rule 4A-46.035, except that if a contractor installs the underground pipe he shall be responsible for that portion of the system, and the Contractor installing the remaining portion shall be responsible for the system from the point of connection to the underground throughout the remainder of the system.

(2) The complete system begins at the point-of-service as defined in Section 633.021(16), Florida Statutes, and ends at the most remote head inside the facility.

(3) In order to ensure that sufficient water is available at the point-of-service to provide the water inside the facility as required by the plans, the contractor who installs the underground portion shall be responsible for conducting the acceptance tests required by Section 1-11, NFPA 13 and shall personally, sign and maintain on file the Contractor’s Material and Test Certificate for Underground Piping as specified in NFPA 13, as adopted in Rule 4A-46.035.
(a) If the above ground pipe is installed by a contractor other than the one who installed the underground, the contractor shall be responsible to obtain a copy of the underground certificate from the underground contractor and maintain it on file before connection to the underground is made. If the contractor is unable to obtain the certificate, he shall notify the State Fire Marshal.

(4) Upon completion of the final installation of the above ground piping, the contractor shall conduct the tests and sign and maintain on file the Contractor’s Material and Test Certificate for Above ground Piping as specified in NFPA 13, as adopted in Rule 4A-46.035.

(5) Failure to complete and maintain the two certificates described in subsections (3) and (4) above shall be grounds for disciplinary action as violations of Section 633.539, Florida Statutes.

(6) The contractor whose name appears on the application for the building permit shall be responsible for the acceptance tests which are required in NFPA 13, Section 1-11. The contractor shall complete all portions of the Contractor’s Material and Test Certificate(s) that are related to the system being tested. The contractor shall sign and date the test certificates. In cases where there may not be a building permit, the contractor that supervised the installation shall be responsible for the performance of these duties.

(7) The contractor shall maintain on file all Contractor’s Material and Test Certificates, and shall provide such to the State Fire Marshal upon his request.

(8) The contractor shall complete and attach to the system a tag as described in 4A-46.041.

Specific Authority : 633.01 F.S.
Law Implemented : 471.025, 553.79(6), 633.065, 633.539, 633.547(2)(e) F.S.
History : New 12-21-88, Amended 8-1-90, 10-20-93.


The contractor shall submit in writing to the State Fire Marshal the names and addresses of all individuals in his employ that are performing inspections of fire protection systems. The contractor shall not allow any individual to perform inspections under his certificate until that individual has been listed with the State Fire Marshal. The contractor shall be responsible for each listed individual’s inspections until he has requested in writing that the State Fire Marshal delete the individual from his list of inspectors.

(1) A Fire Protection Contractor, contracting to perform inspecting, testing, and maintenance service on a fire protection system shall comply with the requirements of the applicable NFPA standard as adopted in 4A-46.035.

(2) Each system that has been inspected, tested, or maintained by a fire protection contractor, or his designated inspector, shall have a record tag placed on the riser or control device.
Appendix J

EXCERPTS FROM TEST PROCEDURES
UNIVERSITY OF FLORIDA COPYRIGHT 1998
TREEO CENTER

DCVA FIELD TEST with DIFFERENTIAL GAUGE - SINGLE HOSE

Prep
NOTIFY CUSTOMER
INSPECT AREA
FLUSH TESTCOCKS
INSTALL FITTINGS
INSPECT TEST KIT - CLOSE ALL NEEDLE VALVES

CV 1
INSTALL COMPENSATION TEE ON TC #2
INSTALL SHORT TUBE ON TC #3
INSTALL TEST GAUGE AND HOSES AT SAME HEIGHT
ATTACH HIGH HOSE TO TC #32
OPEN TC #3 TO FILL TUBE
CLOSE TC #3
OPEN TC #2 SLOWLY
OPEN HIGH BLEED - BLEED AIR FROM GAUGE
CLOSE HIGH BLEED
CLOSE OUTLET SHUT-OFF VALVE
CLOSE INLET SHUT-OFF VALVE
OPEN TC #3 (TC #2 MUST BE OPEN)
Note: GAUGE MUST READ 1.0 psi OR GREATER
RECORD VALUE OF CV 1

CV 2
CLOSE TC 2 AND TC 3
MOVE SHORT TUBE FROM TC #3 TO TC #4
REMOVE HIGH HOSE FROM TC #2
OPEN INLET SHUT-OFF VALVE
ATTACH HIGH HOSE TO TC #3
OPEN TC #4 TO FILL TUBE
CLOSE TC #4
OPEN TC #3 SLOWLY
OPEN HIGH BLEED - BLEED AIR FROM GAUGE
CLOSE HIGH BLEED
CLOSE INLET SHUT-OFF VALVE
OPEN TC #4 (TC #3 MUST BE OPEN)
Note: GAUGE MUST READ 1.0 psi OR GREATER
RECORD VALUE OF CV 2

Final
CLOSE TESTCOCKS - REMOVE ALL EQUIPMENT
OPEN INLET SHUT-OFF VALVE
OPEN OUTLET SHUT-OFF VALVE SLOWLY

5/19/93  rev. 10/24/99
PVB FIELD TEST with DIFFERENTIAL GAUGE

**Prep**
- NOTIFY CUSTOMER
- INSPECT AREA
- REMOVE CANOPY
- FLUSH TESTCOCKS
- INSTALL FITTINGS
- INSPECT TEST EQUIPMENT - CLOSE ALL NEEDLE VALVES

**Air**
- INSTALL TEST GAUGE AND HOSES AT **SAME HEIGHT**

**Inlet**
- ATTACH HIGH HOSE TO TC #2
- OPEN TESTCOCK #2 SLOWLY
- OPEN HIGH BLEED - BLEED AIR FROM GAUGE
- CLOSE HIGH BLEED
- CLOSE OUTLET SHUT-OFF VALVE
- CLOSE INLET SHUT-OFF VALVE
- FINGER IN TOP - OPEN HIGH BLEED
- RECORD WHEN AIR INLET OPENS \( \geq 1.0 \text{ PSI} \)

**Check Valve**
- CLOSE TC #2
- REMOVE HIGH HOSE FROM TC #2
- OPEN INLET SHUT-OFF VALVE
- ATTACH HIGH HOSE TO TC #1
- OPEN TC #1 SLOWLY
- OPEN HIGH BLEED-BLEED AIR FROM GAUGE
- CLOSE HIGH BLEED
- CLOSE INLET SHUT-OFF VALVE
- OPEN TC #2
- WHEN WATER STOPS RUNNING FROM TC #2
- RECORD VALUE OF CHECK VALVE \( \geq 1.0 \text{ PSI} \)

**Backpressure Test (OPTIONAL)**
- OPEN SHUT-OFF #2
- IF WATER CONTINUES TO RUN FROM TC #2
- THEN THE PVB IS SUBJECTED TO BACKPRESSURE
- CLOSE OUTLET SHUT-OFF VALVE

**Final**
- CLOSE TESTCOCKS - REMOVE ALL EQUIPMENT
- REPLACE CANOPY
- OPEN INLET SHUT-OFF VALVE
- OPEN OUTLET SHUT-OFF VALVE SLOWLY

8/18/92 rev. 4/8/98
RP FIELD TEST

Prep
NOTIFY CUSTOMER
INSPECT AREA
FLUST TESTCOCKS (open 4, 3, 2, 1, then close 1, 2, 3, 4)
INSTALL FITTING
INSPECT TEST KIT - CLOSE ALL NEEDLE VALVES

Observe CV 1 ATTACH HIGH HOSE TO TC 2
ATTACH LOW HOSE TO TC 3
OPEN TESTCOCK #3 SLOWLY then OPEN LOW BLEED
OPEN TESTCOCK #2 SLOWLY then OPEN HIGH BLEED
CLOSE BLEEDS - HIGH FIRST, LOW LAST
CLOSE SHUT-OFF #2 (outlet shut-off valve)
OBSERVE CV 1 (record as CLOSED TIGHT or LEAKING)

Record
OPEN HIGH CONTROL VALVE 1 FULL TURN

Relief
OPEN LOW CONTROL SLIGHTLY - NO MORE THAN 1/4 TURN

Valve
RECORD RV OPENING > or = 2.0 psi
CLOSE LOW CONTROL

Observe CV 2 BLEED VENT (BY-PASS) HOSE
leaks
ATTACH TO TC #4
or
CLOSE VENT (BY-PASS) CONTROL
closed
OPEN TC #4
tight
RESET GAUGE - (LOW BLEED)
OPEN VENT CONTROL ONE FULL TURN
OBSERVE WHETHER RELIEF VALVE VENT DRIPS
(If the RELIEF VENT DRIPS, RESET GAUGE {low bleed, IF RELIEF VALVE DRIPS A SECOND TIME, THEN CHECK VALVE 2 HAS FAILED AND MUST BE REPAIRED)
CLOSE VENT (BY-PASS) CONTROL ONLY IF CV LEAKS
(record as CLOSED TIGHT or LEAKING)

Record CV 1
RESET GAUGE - (LOW BLEED)
RECORD CV 1 DIFFERENTIAL > or = 5.0 PSI

Record CV2
CLOSE TC 2 - WAIT & CHECK GAUGE FOR LEAKS
IN OUTLET SHUT-OFF VALVE
CLOSE VENT CONTROL
CLOSE TESTCOCKS 3 & 4
REMOVE VENT HOSE FROM TC 4
RP FIELD TEST (CONTINUED)

MOVE LOW HOSE TO TC 4
MOVE HIGH HOSE TO TC 3
OPEN TC 4 SLOWLY then OPEN LOW BLEED
OPEN TC 3 SLOWLY then OPEN HIGH BLEED
CLOSE HIGH BLEED FIRST, CLOSE LOW BLEED SLOWLY
RECORD CV 2 DIFFERENTIAL > or = 1.0 PSI

Final
CLOSE TESTCOCKS - REMOVE ALL EQUIPMENT
OPEN SHUT-OFF #2 SLOWLY

8/18/92 rev.10/24/99
Appendix K

ORANGE COUNTY UTILITIES
TYPICAL INSTALLATION DETAIL FOR FIRE HYDRANT AND BACKFLOW PREVENTION ASSEMBLY
TEMPORARY WATER SERVICE

1. CUSTOMER/CONTRACTOR SHALL CONNECT HYDRANT METER, BACKFLOW ASSEMBLY, PIPING AND SUPPORT STAND AS ILLUSTRATED BELOW.

2. ALL FITTINGS, PIPING, VALVES AND MATERIALS INCLUDING THE APPROVED REDUCED PRESSURE BACKFLOW STANDARD (ASSE 1013) PREVENTION ASSEMBLY SHALL BE FURNISHED BY CONTRACTOR.

3. BACKFLOW ASSEMBLY SHALL BE TESTED ON INITIAL USE AND ANNUALLY THEREAFTER.

4. CONTRACTOR/CUSTOMER SHALL PROVIDE PROTECTION FOR ASSEMBLY FROM DAMAGE.

WARNING
CONTRACTOR/CUSTOMER SHALL OPERATE BACKFLOW ASSEMBLY VALVE ONLY FOR REGULATING FLOW OF WATER.

NOTE: ADJUSTABLE PIPE SUPPORT BY CONTRACTOR

HYDRANT OPERATING NUT SHALL BE OPERATED WITH A HYDRANT WRENCH AND OPENED FULLY (DO NOT THROTTLE)

HYDRANT ADAPTER
WATER METER
BACKFLOW ASSEMBLY VALVE (*)
REDUCED PRESSURE BACKFLOW PREVENTER ASSEMBLY STANDARD ASSE 1013, BY CONTRACTOR
CONNECTION BY CONTRACTOR/CUSTOMER

EXISTING FIRE HYDRANT
GRADE

MIN. 12"
Appendix L

September 2002 Revision 1

- Manual Cover, changed photo, removed policy from title and added revision date.
- Manual Cover date change from April 2001 to January 2005 and cover page picture change.
- Page 9, Hydrant Meter Connection DCVA to RPBA.
- Page 26, Dual Check wording.
- Page 69, Appendix E, Replaced old Orange County Plumbing Code with Florida Building Code/Plumbing, Selected Portions.
- Page 91, removed old Appendix J Health Programs 10D-9, not applicable, changed to test procedures.
- Page 95, added new Appendix K, Fire Hydrant and Backflow Protection.
- Page 96, added new Appendix L, Revisions to Manual Section.