STATE OF CALIFORNIA
HEALTH AND WELFARE AGENCY
DEPARTMENT OF HEALTH SERVICES

GUIDANCE MANUAL FOR
CROSS CONNECTION CONTROL PROGRAMS

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PUBLIC WATER SUPPLY BRANCH
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   (reprinted by permission of USC Foundation for Cross Connection Control and Hydraulic Research)
FOREWORD

The major goal of the Department of Health Services, Public Water Supply Branch is to ensure the distribution of a safe and potable water supply to all domestic water users. Part of accomplishing this goal is preventing the contamination of these water supplies through cross connections. To this end, the Department published its "Manual of Cross Connection Control Procedures and Practices" in July 1981. The purpose of the manual was to provide guidance to water utilities and health agencies in establishing adequate cross connection control programs.

In July 1987 the Department of Health Services revised its Cross Connection Control Regulations. These changes make it necessary to revise the manual, to bring it into conformity with the new regulations. The updated manual provides the information necessary for a water utility to comply with the revised cross connection regulations.

One of the most important changes in the new regulations is the requirement that all water utilities, both large and small, establish a program for cross connection control. The regulations also specify the minimum elements that such programs must address. This manual discusses the minimum program elements in detail, and defines what constitutes a program that is acceptable to the Department.

Water suppliers should be aware that the Department will pursue enforcement against water utilities that fail to comply with the Cross Connection Control Regulations, and will use the system of administrative orders, citations, and fines authorized under Article 7 of the California Health and Safety Code to secure compliance. The Department therefore encourages water utilities to use the contents of this manual to establish cross connection control programs that conform with the new regulations.
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Chapter I. INTRODUCTION

A. Statutory Requirements

The purpose of this manual is to assist water supplier and other local officials in establishing a cross connection control program. The program outlined in this manual lists each of the elements required by the Regulations Relating to Cross Connection Control found in Title 17 of the California Code of Regulations, Sections 7583 through 7605. (Hereinafter, these Sections will simply be referred to as the "Regulations".) When implementing a cross connection control program, however, a water supplier must also recognize the need to adhere to all of the following standards, regulations and laws:

1. The Uniform Plumbing Code (current edition)

This code gives standards for properly installing plumbing devices on potable water plumbing systems. Adhering to the Uniform Plumbing Code will help to minimize the occurrence of unprotected cross connections, therefore the water supplier should make sure all his public water system facilities conform to this Code.

In addition, the water supplier should work with his customers and local building officials to help ensure that customers' on-premises piping conforms to the code.

2. Section 4017 of the California Health and Safety Code (H&S Code), and Section 64566 of the California Code of Regulations (CCR)

These sections require water utilities to maintain distribution system pressures that are adequate to prevent backspillage under normal conditions, and define "adequate" pressure under various conditions. Conforming to these will help prevent backflow under normal operating conditions.

3. Section 13114.7 of the California Health and Safety Code

Section 13114.7 of the H&S Code prohibits the installation of backflow protection assemblies on Class 1 and Class 2 fire protection systems. Additional guidance on this issue is given in an Informational Bulletin jointly issued by the Department of Health Services and the Office of the State Fire Marshall.

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1/ While the male pronoun is used in this manual for convenience, it should be assumed to indicate either male or female gender in all cases.
4. Sections 4049.50 and 4049.51 of Chapter 7.9 of the H&S Code

These sections authorize local health agencies to initiate cross connection control programs, and to recover the costs of the program through inspection fees.

The text of the Regulations, as well as items 2, 3, and 4 above are included in Appendix A. The Uniform Plumbing Code can be obtained at local reference bookstores.

B. Definitions

1. Air-Gap Separation: The term "air-gap separation" means a physical break between a supply pipe and a receiving vessel. The air-gap shall be at least double the diameter of the supply pipe measured vertically above the top rim of the vessel, in no case less than one inch.

2. Backflow Prevention Assembly: The term "backflow prevention assembly" shall mean an assembly that has passed laboratory and field evaluation tests performed by a recognized testing organization; i.e., a testing organization that has demonstrated its competency to perform such tests to the California Department of Health Services. 2/

3. Approved Water Supply: The term "approved water supply" means any water supply whose potability is regulated by a State or local health agency.

4. Auxiliary Supply: The term "auxiliary supply" means any water supply on or available to the premises other than the approved water supply.

5. AWWA Standard: The term "AWWA Standard" means an official standard developed and approved by the American Water Works Association (AWWA).

6. Backflow: The term "backflow" shall mean a flow condition, caused by a differential in pressure, that causes the flow of water or other liquids, gases, mixtures or substances into the distributing pipes of a

2/ In this manual the term "backflow prevention assembly" shall be used instead of the equivalent terms, "approved backflow prevention device" and "backflow preventer" that appear in the Regulations. Unapproved devices or assemblies, where they are mentioned in this manual, are noted as such.
potable supply of water from any source other than an approved water supply source. Backsiphonage is one cause of backflow. Backpressure is the other cause.

7. **Contamination:** The term "contamination" means a degradation of the quality of the potable water by any foreign substance which creates a hazard to the public health or which may impair the usefulness or quality of the water.

8. **Cross Connection:** The term "cross connection" as used in this manual means any unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome, and potable. Bypass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur, shall be considered to be cross connections.

9. **Double Check Valve Assembly:** The term "double check valve assembly" means an assembly of two independently acting, internally loaded check valves including resilient seated shutoff valves on each end of the assembly, and test cocks for testing the watertightness of each check valve.

10. **Health Agency:** The term "health agency" means the California Department of Health Services, or the local health agency with respect to a small water system.

11. **Local Health Agency:** The term "local health agency" means the county or city health authority.

12. **Person:** The term "person" means an individual, corporation, company, association, partnership, municipality, public utility, or other public body or institution.

13. **Premises:** The term "premises" means any and all areas on a customer's property which are served or have the potential to be served by the public water system.

14. **Public Water System:** The term "public water system" means a system for the provision of piped water to the public for human consumption which has five or more service connections or regularly serves an average of 25 individuals daily at least 60 days out of the year.
15. **Reclaimed Water**: The term "reclaimed water" means a wastewater which as a result of treatment is suitable for uses other than potable use.

16. **Reduced Pressure Principle Backflow Prevention Assembly**: The term "reduced pressure principle backflow prevention assembly" means an assembly incorporating two check valves and an automatically operating differential relief valve located between the two checks, a resilient seated shutoff valve on each end of the assembly, and equipped with necessary test cocks for testing the assembly.

17. **Service (User) Connection**: The terms "service connection" and "user connection" refer to the point of connection of a user's piping to the water supplier's facilities.

18. **Water Supplier**: The term "water supplier" means the person who owns or operates the approved water supply system.

19. **Water User**: The term "water user" means any person obtaining water from an approved water supply system.

C. **Responsibility and Scope of Program**

1. **General**

Implementing the various elements of an effective cross connection control program requires the full cooperation of water users, water suppliers, health agencies, plumbing officials, and water supervisors. Each must carry his share of a coordinated cross connection control program in order to prevent contamination of the potable water supply. If the drinking water system on a premises is found to be contaminated, the health agency and the water supplier should be promptly notified and appropriate measures taken to eliminate the contamination. The responsibilities of the various entities involved in the implementation of a cross-connection control program are outlined below.

a. **Water User (Property Owner or Consumer)**

The water user has the primary responsibility to keep contaminants out of the potable water system. This responsibility begins at the user connection and includes any and all water distribution piping on the premises. If a cross connection or the potential for a cross connection exists the water user shall install,
have tested, and maintain backflow preventers at his own expense as directed by the water supplier or the health agency. The water user should be careful not to create cross connections when modifying his plumbing system.

b. Water Supplier

The water supplier has the responsibility to prevent contamination of the public water system by backflow. This responsibility begins at the source and ends at the user connection, and includes the entire water supplier distribution system. The water supplier has the responsibility for promulgating and enforcing laws, rules, regulations, and policies necessary to carry out his responsibilities. The water supplier also must maintain adequate pressure in his distribution system to minimize the potential for backsiphoning contaminants into the system.

c. Health Agencies

The State Department of Health Services (Department) has the responsibility for promulgating and enforcing laws, rules, regulations, and policies to be followed in controlling cross connections. Local health agencies may establish their own laws or rules for controlling cross connections. In addition, local health agencies are authorized under State Law to implement their own cross connection control programs. In such cases the agency may assume all or a portion of the responsibility for a program under an agreement with local water suppliers, although the water supplier will still be held accountable for the adequacy of such a program. In any case, the local health agency has the authority to ensure that adequate protection is provided within a user's premises.

d. Plumbing Official

The plumbing official has the responsibility for the enforcement of plumbing regulations concerned with preventing cross connections.

e. User Supervisor

As stipulated in the Regulations, the health agency or the water supplier may, at their discretion, require an industrial water user to designate a user supervisor to be responsible for the cross connection control program.
within the water user's premises. This user supervisor shall review the installation and use of pipelines and equipment to ensure that cross connections are eliminated.

2. **Water Suppliers**

The Regulations require every public water system to have a cross connection control program to protect the public water supply from contamination. To meet these requirements each program must, as a minimum, contain the following elements:

a. The adoption of operating rules or ordinances to implement the cross connection program. Rules or ordinances must be approved by the health agency before they are officially enacted or adopted. Chapter 3 addresses operating rules and ordinances.

b. The conducting of surveys to identify water user premises where cross connections exist or are likely to occur. This survey must be comprehensive and system wide, and must be documented in such a way that the results may be reviewed and approved by the health agency. Chapter 4 addresses system surveys and evaluation of cross connection hazards.

c. The provisions of backflow protection by the water user at all connections where a cross connection hazard has been identified. The backflow protection may be installed at the user's connection or within the user's premises or both. Chapter 5 addresses providing backflow protection.

d. The provision of at least one person trained in cross connection control to carry out the program. This person must be employed by or under contract to the water supplier. He must be able to conduct inspections to determine the presence of cross connection hazards, and must be able to administer the cross connection control program so that it meets all the requirements of the Regulations. Chapter 6 addresses cross connection program personnel.

e. The establishment of a procedure or system for testing backflow prevention assemblies. Chapter 7 addresses assembly testing.
f. The maintenance of records of locations, tests, and repairs of backflow prevention assemblies within each water supplier's distribution system. These records must be comprehensive to enable the water supplier to administer the program effectively, and to demonstrate to the health agency that all the requirements of the Regulations are being met. Chapter 8 addresses establishing and maintaining adequate cross connection control records.

These elements are the minimum requirements of the Regulations. Their implementation does not necessarily guarantee that a water supplier's system will be protected from contamination due to cross connections. Special circumstances may require a water supplier to have additional elements in his cross connection program. Such circumstances should be discussed with the health agency before action is taken to address them.

D. Types of Cross Connection Control Programs

The water supplier has the responsibility of protecting the public water supply from contamination occurring through backflow. This can only be achieved by implementing an effective cross connection control program. The program, or any portion thereof, may be implemented directly by the water supplier or through a contract with another agency (typically the local health agency) approved by the Department of Health Services. The method that a water supplier chooses to implement a cross connection control program must, as a minimum, meet the requirements of the Regulations.

A number of different approaches, reflecting local conditions, have been developed to meet the needs and requirements of a cross connection control program.

The type of program a water supplier chooses to meet the requirements of the Regulations is his own prerogative. A water supplier should, however, coordinate with the Department of Health Services and the local health agency to determine the most effective and economical means for establishing and carrying out a program.

Three basic approaches are described below.

1. Water Supplier/Local Health Agency Contract Program

In this type of program, water suppliers join together to contract with a local health agency for the services of competent cross connection control specialists. The
qualifications of a cross connection specialist are described in Chapter 6. These persons are responsible for conducting a cross connection control program for the suppliers and health agency. Since this staff is employed by the local health agency, both internal protection and premises isolation may be provided. This type of program helps to minimize the financial burden of managing a cross connection control program, promotes impartiality, and helps create a uniformity of approach to cross connection procedures and requirements in a given area. The Department encourages water suppliers to consider joining such existing programs or working to establish joint programs of this type.

2. **Water Supplier/Cross Connection Control Specialist Contract Program**

In this type of program, an individual water supplier or group of water suppliers contracts with a trained and qualified cross connection control specialist to effectively carry out a competent cross connection control program. This persons must be acceptable to the health agency, and is responsible for conducting a cross connection control program for the water suppliers. This approach can be very effective in areas where there are a large number of small utilities that individually are unable to support a full-time qualified person, and where a joint program with a local health agency is infeasible.

3. **Independent Water Supplier Program**

Another approach is for a water supplier to have his own cross connection control program, independent of the local health agency or other water utilities. The water supplier must have a trained cross connection control specialist, acceptable to the health agency, to carry out the program. For such reasons as uniformity, cost, and technical support a water supplier should investigate the option of joining an existing county program or a joint program with other water suppliers before initiating an independent program.
Chapter II. CAUSES OF BACKFLOW

A. Backflow Caused by Backsiphonage

Backsiphonage is backflow caused by negative or reduced pressure in the supply piping. The principal causes of backsiphonage are:

1. Undersized supply piping;

2. Waterline repairs or breaks at a location lower than a water service point;

3. Reduced water system pressure caused by high water use, such as fire fighting, construction uses, or water main flushing;

4. Reduced water system pressure on the suction side of an on-line booster pump.

B. Backflow Caused by Backpressure

Backflow caused by backpressure occurs when the user's system is at a higher pressure than the public water system. Sources of backpressure include:

1. Booster pumps that supply water to industrial fluid piping systems;

2. Potable water system connections to pressurized industrial fluid systems (e.g., boilers);

3. Interconnections with other piping systems that operate at a higher pressure than the domestic system;

4. Thermal expansion in water heaters.
Example of Backsiphonage Due to High Withdrawal of Water: The illustration on page II - 3 shows how main pressure can be reduced due to high withdrawal of water, causing a backflow condition. Under normal flow conditions (dotted line on graph), the distribution pressure varies from 100 psi where it enters the grid to 50 psi at the hydrant on the far side of the grid. (NOTE: Under normal flow conditions, all premises being served fall below the dotted line.) Assume the hydrant at point F is opened and the valve at point E 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 E; therefore, when the hydrant is opened, the pressure at that point 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 now been reduced to a point where it is lower than those areas that fall above the line. Therefore, the water will flow toward the lower pressure zone, causing a potentially serious backflow condition.

The above backflow condition can be aggravated by the addition of booster pumps either on the fire truck or within a building's fire system.
Figure II-1
BACKSIPHONAGE DUE TO HIGH WITHDRAWAL OF WATER

Source of Supply

Open Hydrant
Closed Gate

Swimming Pool

Storage Tanks

HYDRAULIC GRADIENT

Normal Flow

High Demand

PRESSURE

100 psi (689.5 kPa)

50 psi (345 kPa)

A B C D E
Example of Backflow Due to Backpressure: The illustration on page II - 5 shows how a pump in the customer's water system can increase the pressure to a point where it exceeds the public water system pressure, causing a backflow condition. This example illustrates the common practice of flushing ship fire suppression systems by connecting to dockside freshwater supplies. As shown on the graph, under normal conditions the pressure in the main is 100 psi, and approximately 75 psi 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. If the valve at point A is accidentally left open, the fire system pressure is transferred through the freshwater supply to the city main, at which point the pressure is 150 psi. With the customer's water pressure higher than the public water system pressure, dockside water is forced into the public water supply.
Figure II-2
BACKFLOW DUE TO BACKPRESSURE

HYDRAULIC GRADIENT

- 200 psi (1379 KPa)
- 150 psi (1034 KPa)
- 100 psi (689.5 KPa)
- 50 psi (345 KPa)

Superimposed
Fire System Pressure

Normal Flow

A
Chapter III. ORDINANCE OR RULES OF SERVICE

A. Purpose of Ordinance

The ordinance or rules of service must provide a water supplier with the enforcement authority needed to implement an effective cross connection control program as mandated by the Regulations. The Regulations require each water supplier to adopt an ordinance for this purpose. The ordinance should specifically outline the water supplier's cross connection control program, and give the water supplier authority to take enforcement action (e.g., termination of water service) when necessary.

B. Required Elements of an Ordinance

The following elements must be included in a water supplier's ordinance:

1. A provision for backflow prevention assemblies to be installed, maintained, and tested where needed in accordance with the Regulations.

2. The designation of the party(ies) with the authority and responsibility for implementing the cross connection control program and enforcing the ordinance.

3. A provision for terminating service for failure to install, maintain, test, or repair a backflow prevention assembly or otherwise comply with the ordinance.

4. A provision authorizing the utility to conduct surveys or have surveys conducted on water users' premises to identify where cross connection hazards exist or may occur.

5. The designation of specific types of backflow protection required at premises where hazards exist. The type of protection shall in no case be less stringent than that listed in Table 1 of the Regulations, and may incorporate the Regulations by reference or inclusion.

6. A provision for establishing and maintaining of a list of approved backflow prevention assemblies.

For the rest of this chapter the word "ordinance" will denote any types of regulations, rules, or policies adopted by a water supplier.
4. Smaller health clinics and dental offices pose cross connection hazards. Examples of cross connections commonly found at such facilities are submerged inlets on X-ray machines, dental equipment, or laboratory sinks.

5. General commercial establishments pose a hazard, especially by cross connections with air heating and cooling systems (eg., boilers and "swamp" coolers). Restaurants and commercial launderers often have cross connections (eg., soap dispensers connected to water supply lines). Highrise buildings (three or more stories) pose additional hazards, because they increase the possibility of backflow due to differences in elevation and the possible use of booster pumps or storage tanks in the building. (Booster pumps are especially common in fire suppression systems for highrise buildings.)

6. Irrigation systems pose cross connection hazards, both from backsiphonage of ponded water and the possible use of fertilizer or pesticide injectors. Irrigation systems supplying nurseries, parks, cemeteries, golf courses, and large commercial complexes fall into this category.

7. Any kind of unapproved water supply on a customers' premises, such as a private well or a raw water supply, poses a potential cross connection hazard. This includes water supplies used for irrigation or fire fighting purposes.

8. Residential customers in certain areas may have cross connections. Examples are submerged inlets to swimming pools, auxiliary water supplies, and certain types of heat exchangers used in solar heating systems.

This is not intended to be a comprehensive list of the types of cross connection hazards that a water supplier must be aware of, but is a demonstration of the kind of reasoning that must be used in compiling a priority list of customers that need to be surveyed for cross connection hazards. A water supplier must compile such a list and, beginning with the worst hazards, inspect all premises on the list.

C. Types of Surveys

There are two types of surveys: the initial survey and the follow-up survey. An initial survey is performed either as part
of a newly initiated program, or on a new customer's premises. A
water utility should always be aware of new construction in its
service area, and should review the construction diagrams for
water system piping before a facility is built. Coordination
with the local planning agencies and building departments is
usually necessary.

Follow-up surveys are important in commercial and industrial
areas due to changes in water use among customers. Commercial
and light industrial complexes pose special problems due to
changing tenancy. A water supplier should periodically reinspect
such premises to find changes in water use. Follow-up surveys
may not be necessary, however, where reduced pressure principle
backflow assemblies or air gap separations are in place.

D. Notification Procedures

Unannounced inspections are more productive than announced
inspections, and are preferable if right-of-entry is not a
problem. A water utility, however, may need to notify a customer
ahead of time that it intends to inspect his premises for cross
connections. This notice should explain what cross connections
are and why they are a public health concern.

Following the inspection the utility should send the customer
another letter informing him of the findings, and indicating what
(if any) remedial actions are necessary. The letter (or its
attachments) should give the following information:

1. the service location and account number (or other
   appropriate identification number)

2. the backflow prevention assembly or assemblies required for
   minimum protection

3. a list of backflow prevention assemblies that are acceptable
to the utility and the health agency

4. the requirements for installing the backflow prevention
   assembly or assemblies (supply a plumbing diagram)

5. the requirements for testing backflow prevention assemblies
   (initial and annual)

6. the date by which corrective action must be completed
   (usually a 30 or 60 day period)

7. the authority under which the backflow protection
   requirement is made (State Regulations and utility
   ordinance)
8. the contact person at the utility, including address and phone number

9. the consequences of failure to install, test, or maintain backflow prevention assemblies (i.e., termination of water service)

The letter or its attachments may also discuss:

1. an explanation of why backflow protection is being required, including a description of the actual or potential health hazard presented by this water service

2. alternative ways to eliminate the cross connection or potential cross connection so that protection at the user connection would not be required

3. descriptions of the required backflow prevention assemblies and how they operate (this will warn owners not to make "repairs" that might damage an assembly or make it inoperable)

4. who is responsible for installing, testing, and maintaining the required backflow prevention assembly or assemblies

5. a list of approved backflow prevention assembly testers

6. a list of sources (manufacturers or distributors) of approved assemblies

7. reprints of the state cross connection regulations and the utility's ordinance or rule.

While the letter should give the customer a reasonable deadline to make the necessary modifications, if the water supplier finds a cross connection that represented an immediate and severe threat to public health he should take immediate action.
A. Types of Devices

The Regulations allow only three types of backflow prevention assemblies to be used for abatement of cross connection hazards at a customer's service connection. They are (listed in decreasing level of protection): the air-gap separation; the reduced pressure principle backflow prevention assembly, and the double check valve assembly. While the regulations do not allow the use of an atmospheric vacuum breaker or a pressure vacuum breaker at a water user's connection, in certain instances the use of these assemblies on a user's premises (e.g., on a landscape irrigation system) may preclude the need for service protection. This must be determined on a case-by-case basis by the water supplier and health agency.

Backflow prevention assemblies are defined as follows:

1. **Air-gap Separation (AG)** - a physical break between a supply pipe and a receiving vessel. The Regulations require that the AG must be at least double the diameter of the supply pipe measured vertically above the top rim of the vessel, and in no case less than one inch. Figure V-1 shows typical AG installations.

2. **Reduced Pressure Principle Backflow Prevention Assembly (RP)** - an assembly incorporating two check valves and an automatically operating differential relief valve located between the two checks, a resilient seated shutoff valve on each end of the assembly, and equipped with necessary test cocks for testing the assembly. The Regulations require all RPs to conform to the AWWA Standard C506-78(R83). This type of assembly is designed to protect against both a backpressure and a backsiphonage condition in a high hazard situation. Figure V-2 shows an RP schematic.

3. **Double Check Valve Assembly (DC)** - an assembly of two independently acting, internally loaded check valves including resilient seated shutoff valves on each end of the assembly, and test cocks for testing the watertightness of each check valve. This type of assembly is designed to protect against both a backpressure and a backsiphonage condition. The Regulations require all DCs to conform to the AWWA Standard C506-78(R83). Figure V-3 shows a DC schematic.
Figure V-1
EXAMPLES OF AG INSTALLATIONS

LARGE BUILDING WITH AIR GAP
AT WATER STORAGE TANK

AIR GAP AT MAKEUP TANK FOR
AN AUXILIARY WATER SYSTEM

POTABLE WATER SUPPLY
SHUTOFF VALVE
IF SPLASHING IS A PROBLEM,
TUBULAR SCREENS MAY BE
ATTACHED; HOSES ARE NOT
ALLOWED.

SHUTOFF VALVE
FLOAT VALVES
APPROVED AIR GAP
2 X I.D. MIN.

AUXILIARY
WATER SUPPLY
TANK OUTLET

V - 2
Figure V-2
SCHEMATIC DIAGRAM OF AN RP

NO. 1 SHUTOFF VALVE

CHECK VALVE NO. 1

TESTCOCK NO. 1

CHECK VALVE NO. 2

TESTCOCK NO. 2

TESTCOCK NO. 3

DIFFERENTIAL PRESSURE RELIEF VALVE

TESTCOCK NO. 4

FLOW
Figure V-3
SCHEMATIC DIAGRAM OF A DC

NO. 1 SHUTOFF VALVE

CHECK VALVE NO. 1

CHECK VALVE NO. 2

TESTCOCK NO. 1

TESTCOCK NO. 2

TESTCOCK NO. 3

TESTCOCK NO. 4

NO. 2 SHUTOFF VALVE

FLOW
4. **Pressure Vacuum Breaker (PVB)** - an assembly that has an independently operating, loaded check valve and an independently operating, loaded air inlet valve located on the discharge side of the check valve. The PVB must be equipped with properly located test cocks and tightly closing shutoff valves located at each end of the assembly. This assembly is designed to protect only against a backspphonage condition, not against backpressure. A shutoff valve may be used downstream of a PVB. Figure V-4 shows a PVB schematic.

5. **Atmospheric Vacuum Breaker (AVB)** - an assembly that has a float-check, a check seat and an air inlet port. The flow of water into the body causes the float to close the air inlet port. When the flow of water stops, the float falls, and forms a check against backspphonage. This simultaneously opens the air inlet port, allowing air to enter and satisfy the vacuum. A shutoff valve immediately upstream may be an integral part of the AVB. This assembly is designed to protect only against a backspphonage condition, not against backpressure. A downstream shutoff valve is not permitted. Figure V-5 shows an AVB schematic.

**B. Location of Backflow Prevention Assemblies**

The Regulations require water suppliers to ensure that each water user on whose premise a cross connection hazard exists provides appropriate backflow protection. The type of protection provided to prevent backflow into the public water supply must be commensurate with the degree of hazard on the consumer's premises. Protection may be provided at the user connection (service protection), within the user's premises (on-site protection), or both. Since the water supplier has the responsibility for protecting the public water supply from contamination, he must approve any protection measures taken within a user's premises that preclude the need for the installation of a backflow prevention assembly at the user connection.

1. **User Connection Protection (or Service Protection)**

   Only an AG, RP, or DC may be used to provide service protection. The water user may choose a higher level of protection than required by the water supplier.

   Each type of assembly approved for backflow protection at the user connection has specific requirements for installation. These requirements are as follows:
Figure V-4
SCHEMATIC DIAGRAM OF A PVB
Figure V-5
SCHEMATIC DIAGRAM OF AN AVB

AIR INLET VALVE CANOPY

AIR INLET VALVE

OPTIONAL INTEGRAL SHUTOFF VALVE

FLOW
a) **Air-gap Separation.** An AG must be located as close as practical to the user's connection, and all piping between the user's connection and receiving tank must be entirely visible unless otherwise approved in writing by the water supplier and the health agency. Figures V-6 and V-7 show the installation requirements for an AG.

b) **Reduced Pressure Principle Backflow Prevention Assembly.** An RP must be located as close as practical to the user's connection. This type of assembly must be installed at least twelve inches and not more than thirty-six inches above grade (measured from the lowest point of the assembly), and must have adequate side and top clearance to allow access for testing and maintenance. A minimum side and top clearance of twelve inches should be allowed. Figure V-8 shows typical RP installations with minimum clearances.

c) **Double Check Valve Assembly.** A DC shall be located as close as practical to the user's connection and shall be installed above grade, if possible, and in a manner where it is readily accessible for testing and maintenance. This type of assembly should be installed at least twelve inches and not more than thirty-six inches above grade (measured from the lowest point of the assembly), and must have adequate side and top clearance to allow access for testing and maintenance. A minimum side and top clearance of twelve inches should be allowed.

Figure V-9 shows typical DC installations with minimum clearances.

Where an above-grade installation is impossible due to weather conditions, the DC must be installed in a vault that provides adequate clearances for testing and maintenance. The following are minimum criteria for below-grade installation:

If a DC must be installed below grade, it must be placed in a vault with a minimum of twelve inches between the bottom of the vault and the bottom of the assembly. The top of the assembly must be no more than eight inches below grade. There must be at least 24 inches of clearance between the side of the assembly with the test cocks and the side of the vault, and at least twelve inches clearance between the other side of the assembly and the side of the vault. The vault must
Figure V-6
INSTALLATION REQUIREMENTS FOR AN AG

TANK SHOULD BE OF SUBSTANTIAL CONSTRUCTION AND
OF A KIND AND SIZE TO SUIT CONSUMER'S NEEDS.
TANK MAY BE SITUATED AT GROUND LEVEL (WITH A
PUMP TO PROVIDE ADEQUATE PRESSURE HEAD) OR
BE ELEVATED ABOVE THE GROUND.

AIR-GAP SEPARATION
Figure V-7
ALTERNATIVE INSTALLATION REQUIREMENTS
FOR AN AG

- DESIGN, FABRICATION, INSTALLATION, AND OPERATION MUST COMPLY WITH STANDARDS OF THE AMERICAN WATER WORKS ASSOCIATION (AWWA) AND ALL FEDERAL, STATE, AND LOCAL LAWS, RULES, REGULATIONS, ORDERS, CODES, AND ORDINANCES.

- NO CONNECTIONS SHALL BE MADE BETWEEN METER AND RECEIVING VESSEL.

- THE OVERFLOW OPENING AND SCREEN SIZE SHALL BE AS SHOWN HEREIN OR OF GREATER CAPACITY AS REQUIRED TO MAINTAIN THE SPECIFIED AIR GAP SEPARATION.
Figure V-8
INSTALLATION REQUIREMENTS FOR AN RP

ABOVE GROUND

IN BUILDING

IN BASEMENT

PLAN VIEW

PROTECTIVE ENCLOSURE OPTIONAL

MINIMUM CLEARANCE 12"

FLOW

ADEQUATE DRAIN REQUIRED

FLOW

FLOW

FLOW

12" MINIMUM

24" MINIMUM

ENCLOSURE

ADEQUATE CLEARANCE FOR OPERATION OF VALVES

V-II
Figure V-9
INSTALLATION REQUIREMENTS FOR A DC

PROTECTIVE ENCLOSURE OPTIONAL
MINIMUM CLEARANCE 12"

FLOW
ADEQUATE DRAIN REQUIRED

IN BUILDING

FLOW
ADEQUATE DRAIN REQUIRED

IN BASEMENT OR VAULT

FLOW
ADEQUATE DRAIN REQUIRED

PLAN VIEW

12" MINIMUM

24" MINIMUM

ADEQUATE CLEARANCE FOR OPERATION OF VALVES

V-12
have adequate drainage to prevent flooding. Vaults that do not have an integrated bottom must be placed on a three inch (3"") layer of gravel.

2. **On-Site Protection**

All proposals for on-site protection in lieu of service protection must be evaluated on a case-by-case basis. In evaluating each case the water supplier must consider the complexity of the piping system within the user's premises, the degree of the cross connection hazard to be protected against, whether other hazards exist on the site, and any other special circumstances which might preclude the use of on-site backflow protection. The final decision rests in the hands of the water supplier or the health agency.

A common application of on-site protection are AVBs and PVBs installed on landscape irrigation systems where injection of fertilizers or pesticides (chemigation) is not practiced. These assemblies should be used with discretion, however, due to the possible future use of a chemigation system. Proposals to use AVBs or PVBs within an irrigation system in lieu of providing protection at the user connection must be examined on a case-by-case basis.

Figure V-10 shows a typical installation of an AVB. No shutoff valves may be located on the discharge side of the AVB. The AVB must also be mounted at least 6 inches above the highest downstream outlet. It should be noted that the current edition of the Uniform Plumbing Code prohibits the installation of an AVB where it will be subject to continuous pressure for more than 12 hours. An AVB will tend to freeze in the open position under these conditions.

Figure V-11 shows a typical PVB installation. The PVB must be mounted so that its critical level (i.e., the level of the PVBs internal check valve) at least 12 inches above the highest downstream outlet.

**C. Examples of Application**

1. **Type of Protection Required**

The minimum types of backflow protection required to protect the public water supply, at the user's water connection to premises with varying degrees of hazard are given in Table 5-1 (excerpted from the Regulations). Situations not covered in Table 5-1 must be evaluated on a case-by-case basis, and the appropriate backflow protection must be determined by the water supplier or health agency.
Figure V-10
TYPICAL INSTALLATION OF AN AVB

FLOW

MINIMUM OF 6" ABOVE HIGHEST OUTLET

ABSOLUTELY NO MEANS OF SHUT-OFF ON THE DISCHARGE SIDE OF THE VACUUM BREAKER
Figure V-11
TYPICAL INSTALLATION OF A PVB

FLOW

CRITICAL LEVEL

MINIMUM OF 12" ABOVE HIGHEST OUTLET

DOWNSTREAM SIDE OF VACUUM BREAKER MAY BE MAINTAINED UNDER PRESSURE BY A VALVE. BUT, THERE MAY BE ABSOLUTELY NO MEANS OF IMPOSING PRESSURE BY PUMP OR OTHER MEANS.
<table>
<thead>
<tr>
<th>Degree of Hazard</th>
<th>Minimum Type of Backflow Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Sewage and Hazardous Substances</td>
<td></td>
</tr>
<tr>
<td>(1) Premises where the public water system is used to supplement the reclaimed water supply.</td>
<td>AG</td>
</tr>
<tr>
<td>(2) Premises where there are wastewater pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and the water supplier.</td>
<td>AG</td>
</tr>
<tr>
<td>(3) Premises where reclaimed water is used and there is no interconnection with the potable water system. A RP may be provided in lieu of an AG if approved by the health agency and the water supplier.</td>
<td>AG</td>
</tr>
<tr>
<td>(4) Premises where hazardous substances are handled in any manner in which the substances may enter a potable water system. This does not include a single family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and the water supplier.</td>
<td>AG</td>
</tr>
<tr>
<td>(5) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected.</td>
<td>RP</td>
</tr>
<tr>
<td>(b) Auxiliary Water Supplies</td>
<td></td>
</tr>
<tr>
<td>(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and the water supplier.</td>
<td>AG</td>
</tr>
</tbody>
</table>
### Table 5-1
(continued)

<table>
<thead>
<tr>
<th>Degree of Hazard</th>
<th>Minimum Type of Backflow Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Premises where there is an unapproved auxiliary water supply and there are no interconnections with the public water system.</td>
<td>RP</td>
</tr>
<tr>
<td>A DC may be provided in lieu of a RP if approved by the health agency and water supplier.</td>
<td></td>
</tr>
</tbody>
</table>

(c) Fire Protection Systems

1. Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected). DC

2. Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and water supplier. AG

3. Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from the private reservoirs or tanks are used. DC

(d) Dockside Watering Points and Marine Facilities

1. Pier hydrants for supplying water to vessels for any purpose. RP

2. Premises where there are marine facilities. RP

(e) Premises where entry is restricted so that inspection for cross-connections cannot be made with sufficient short notice to assure that cross-connections do not exist. RP

(f) Premises where there is a repeated history of cross connections being established or re-established. RP
2. **Recommended Backflow Prevention Assembly Installation Practices**

a) **Wastewater and Toxic Chemicals**

An AG or RP must be provided at services to sewage treatment plants, sewage pumping stations, reclaimed water reuse areas, and areas where toxic substances are handled in a manner in which the substances may enter the potable water system. Under no circumstances should there be any connection between the potable supply and piping containing substances that may cause a severe health hazard. Sewage treatment plants, reclaimed water use areas, and areas where toxic chemicals are handled should be protected by both premises isolation and internal protection.

The degree of treatment of reclaimed water must not be considered in determining the protection necessary for areas where it is used, since even tertiary treated wastewater is a potential health hazard. Treatment system failures do occur.

With the exception of single family residential property, any premises with an individual sewage pump must be isolated with a RP at the user connection. Single family residences with an individual sewage pump should be evaluated on a case-by-case basis, and protected in accordance with the criteria given in Appendix C.

Figures V-12 and V-13 show example applications of isolating high-hazard cross connections.

b) **Auxiliary Water Systems**

A backflow prevention assembly must be installed at the user connection to any premises where there is an unapproved auxiliary water supply or system, even if there is no piping connection between the two systems. (See Appendix C for exceptions.) No backflow protection is necessary if the auxiliary water system holds a valid water supply permit issued by the health agency, and if the water supplier accepts the auxiliary source as an additional supply.

(c) **Irrigation Systems**

PVBs or AVBs may be used for backflow protection on landscape irrigation systems. These assemblies, however, must not be used to provide service protection, nor can they be used in areas where they are subject to backpressure. When there is a possibility of backpressure, RPs are required.
Figure V-12
CROSS CONNECTION CONTROL FOR A RECLAIMED WATER USE AREA

Diagram showing the layout of a reclaimed water use area with connections to a city main, a water meter, and storage facilities.
Figure V-13
CROSS CONNECTION CONTROL FOR A SEWAGE TREATMENT PLANT

SEWAGE TREATMENT PLANT
— SEVERE HEALTH HAZARD

This is an illustration of premises containing an extreme health hazard where in-plant protection and service protection are recommended.
An AG or an RP must be used in all cases where fertilizers, herbicides, or pesticides are or can be injected into the irrigation system.

The following sections describe appropriate uses of backflow prevention assemblies on irrigation systems.

(i) **Hillside Irrigation with Water Service at Bottom**

   a. Atmospheric Vacuum Breaker: Note there are no shutoff valves downstream from the vacuum breaker (see Figure V-14, upper portion).

   b. Pressure Vacuum Breaker: Note that shutoff valves may be located anywhere in the system (see Figure V-14, lower portion).

   c. Reduced Pressure Principle Assembly: Note that the assembly may be located at the bottom of the slope, and that shutoff valves may be located anywhere in the system. Also, the chemical injector pump may be included in this system (see Figure V-15).

(ii) **Level Terrain—Multizone Irrigation System**

   a. Atmospheric Vacuum Breaker: Installed downstream of last shutoff valve (see Figure V-16, upper portion).

   b. Pressure Vacuum Breaker: No restriction on shutoff valve location (see Figure V-16, lower portion).

   c. Reduced Pressure Principle Assembly: May also be installed on these systems if required.
Figure V-14
USE OF AVB'S AND PVB'S ON HILLSIDE IRRIGATION SYSTEMS

ATMOSPHERIC VACUUM BREAKER
SHUTOFF VALVE - MUST BE
UPSTREAM FROM VACUUM
BREAKER

6" MINIMUM ABOVE
HIGHEST SPRINKLER
HEAD

SHUTOFF
VALVE

PRESSURE VACUUM BREAKER

12" MINIMUM
ABOVE HIGHEST
SPRINKLER
HEAD

SHUTOFF
VALVES - MAY BE
DOWNSTREAM FROM
PRESSURE VACUUM
BREAKER
Figure V-15
USE OF RP'S ON
HILLSIDE IRRIGATION SYSTEMS

(ENCLOSURE OPTIONAL)

REDUCED PRESSURE PRINCIPLE DEVICE

SHUTOFF VALVES

INJECTOR PUMP
Figure V-16
CROSS CONNECTION CONTROL FOR
LEVEL TERRAIN, MULTIPLE ZONE
IRRIGATION SYSTEMS

WITH ATMOSPHERIC VACUUM BREAKER

6'' MINIMUM
ABOVE HIGHEST
SPRINKLER HEAD

ATMOSPHERIC
VACUUM BREAKER

SHUTOFF
VALVES - MUST
BE UPSTREAM
FROM ATMOSPHERIC
VACUUM BREAKER

WITH PRESSURE VACUUM BREAKER

12'' MINIMUM
ABOVE HIGHEST
SPRINKLER HEAD

PRESSURE
VACUUM
BREAKER

SHUTOFF
VALVES - MAY
BE DOWNSTREAM
FROM PRESSURE
VACUUM BREAKER
(d) **Fire Systems**

A fire suppression system with a direct connection to the public potable water system should be protected in a manner commensurate with the hazard. Fire suppression systems may be classified as follows:

(i) **Class I** - Direct connections from domestic water mains only; no pumps or reservoir; no physical connections to other water supplies; no anti-freeze or other additives of any kind; and all sprinkler drains discharge to atmosphere.

(ii) **Class II** - Same as Class I, except that booster pumps may be installed in the service lines from the street mains. A connection for a fire pumper truck may be provided if the requirements outlined in the Joint Informational Bulletin are met. (See Appendix A).

(iii) **Class III** - Direct connection to public water supply main, with on-site storage or pressure tanks. All storage facilities must only be filled by or connected to the public water supply, and the water in these facilities must be maintained in a potable condition.

(iv) **Class IV** - Directly supplied from public mains similar to Classes I and II, with an unapproved auxiliary water supply on or available to the premises, or a connection for fire pumper trucks that does not meet the requirements in the Joint Informational Bulletin.

(v) **Class V** - Directly supplied from public mains and interconnected with unapproved auxiliary supplies, such as: pumps taking suction from reservoirs exposed to contamination, or from rivers, ponds, wells, or industrial water systems; or systems where antifreeze or other additives are used.

(vi) **Class VI** - Fire suppression systems supplied from both an industrial water system and the public water system, with or without gravity storage or pump suction tanks.

Class I and II fire suppression systems do not require backflow protection at the service connection, except as provided for in the Joint Informational Bulletin.
A connection to a Class III system must be protected with a DC.

A connection to a Class IV system must be protected with at least a DC. An AG or RP may be required, depending on the quality of the auxiliary supply, or the hazard posed by the pumper truck connection.

A connection to a Class V system must be provided with maximum protection (AG or RP).

Backflow protection for a Class VI system depends on the type of industry served and fire protection system being used, and must be determined by a survey of the premises.

A meter (compound, detector check) should not be permitted as part of a backflow prevention assembly, unless the meter and the backflow prevention assembly are specifically designed and approved for that purpose.

e) Dockside Watering Points and Marine Facilities

The actual or potential hazard to any water system posed by a marine facility or dockside watering point must be evaluated on a case-by-case basis. The basic risk is that pumps aboard a vessel could force contaminated water into the water supply system. The same risk occurs in areas where dockside watering facilities are used in connection with marine construction, maintenance or repair, and permanent or semi-permanent moorages.

The following are guidelines for providing backflow protection for marine facilities:

(i) all direct water connections to vessels must be protected by RPs. All hydrants in the dockside area used or available for use in providing water to vessels must also have RPs. The entire dockside area should be isolated from the water supplier's system by an RP.

(ii) Marine repair facilities should have RPs installed at the user connections.

(iii) Small boat moorages that maintain hose bibs on a dock or float should have an RP installed at the user connection, and a properly installed AVB or PVB on all hose bibs. If a sewage pump station is provided, the water line to the pump station should be isolated by installation of an RP.

Figures V-17 and V-18 show example applications of isolating cross connections at marine facilities.
Figure V-17
CROSS CONNECTION CONTROL FOR MARINE FACILITIES
REPAIR AND CARGO LOADING OPERATIONS

MARINE REPAIR FACILITIES
— SEVERE HEALTH HAZARD

MARINE CARGO HANDLING FACILITIES
— SEVERE HEALTH HAZARD

To Building Fire Sprinkler System
To Commercial User

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Figure V-18
CROSS CONNECTION CONTROL FOR MARINE FACILITIES WITH AUXILIARY WATER SUPPLIES

WATER CONNECTION DIRECTLY TO VESSELS OR MARINE FIRE PROTECTION SYSTEM

PREMISES WITH AUXILIARY WATER SUPPLY FOR SMALL BOAT MOORINGS

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(f) Portable Spray and Cleaning Equipment

All portable pressure spray or cleaning units (e.g., pesticide applicators, carpet cleaners, mobile auto service units) that have the capability of connecting to a public water system should be equipped with an AG or an RP (see Figure V-19).

(g) Cross Connections Through Air Valves

All air valves should be vented above ground. If the mouth of the vent is in a pit, water from the pit will be backsiphoned into the pipe if a vacuum condition develops in the pipe while the pit is flooded (see Figure V-20).

The term "air valve" generally refers to two types of valves: air/vacuum valves, and air release valves.

The air/vacuum valve is used to automatically allow air to enter a pipe when the pipe is drained. Allowing air to enter a thin-walled pipe prevents collapse of the pipe due to a vacuum created by draining the pipe, and helps to prevent a backsiphonage condition in services on the pipe.

The air release valve is used to release the small amount of air that accumulates at high points in a pipeline that restricts the flow capacity of the pipe.

(h) Miscellaneous Uses of Water From Fire Hydrants

A number of water suppliers allow the use of water directly from fire hydrants for flushing storm or sanitary sewers. An AG is required when this is practiced to protect the water supplier's system. An RP may be acceptable protection for other uses (e.g., construction water, water hauling trucks, or hydro-sodding equipment).
Figure V-19
APPROVED METHODS FOR FILLING
PORTABLE SPRAY AND CLEANING EQUIPMENT

PERMANENTLY ATTACHED PIPE

HOSE CONNECTION

AG

RP

V-30
Figure V-20
APPROVED AIR VALVE INSTALLATION
Chapter VI. CROSS CONNECTION PROGRAM PERSONNEL

A. Cross Connection Program Manager

The cross connection program manager has overall responsibility for the program. He is responsible to have customers' premises surveyed for cross connections, making sure that the hazards are abated, and ensuring that the backflow prevention assemblies in the water system are tested periodically and functioning properly. The manager is the primary contact person in matters related to the program. He is responsible for seeing that the records related to the cross connection program are maintained.

The program manager must be competent and experienced in matters related to cross connection control. Specifically, he must have experience and/or training in administering cross connection control programs and inspecting users' premises for cross connections, and must be familiar with the design of backflow prevention devices and the procedures for installing and testing them.

The California-Nevada Section of the American Water Works Association (AWWA) has a voluntary certification program for cross connection program specialists. Persons certified under this program will have the qualifications required for program managers.

B. Backflow Prevention Assembly Tester

The backflow prevention assembly tester is responsible for testing and/or repairing backflow prevention assemblies, and providing the water user with a copy of the test results. The water supplier may also require a copy of this report. The tester may be employed by either the water utility or the water user.

The tester must have demonstrated his competence in testing these devices to the satisfaction of the water supplier. In addition, the tester should be certified under a program acceptable to the water supplier that provides periodic reexaminations to ensure his continued competence. Presently the AWWA, as well as a number of counties, provide such certification programs.

C. User Supervisor

In some circumstances an industrial customer will have a multipiping system that conveys various types of fluids, some of which may be hazardous. Due to the complexity of such a system and the possibility of frequent changes in the plumbing, the health agency and the water utility may, at their discretion,
require an industrial customer to designate a User Supervisor. This person will be responsible to ensure that cross connections are not made during the installation, operation, and maintenance of the customer's piping and equipment.

A User Supervisor must be familiar with practices and regulations regarding cross connection control and plumbing, and must be intimately familiar with the water use practices within the customer's facility. Formal training and certification as a Cross Connection Program Specialist and/or a Backflow Prevention Assembly Tester is desirable.
Chapter VII. TESTING PROGRAM

A. Initial and Periodic Testing

The Regulations require that assemblies be tested immediately after they are installed, relocated, or repaired, and not be placed in service unless they are functioning as required. In addition, the assemblies must be tested at least annually.

Some water suppliers carry out the entire cross connection program, including testing of the assemblies. Such suppliers may recover program costs by charging the affected users for the costs of testing as part of their water bill. Generally, repair or replacement of the assembly is the responsibility of the water user. In this case the water supplier must require the user to have the assembly tested.

B. Customer Notification

If the supplier does not conduct the testing himself, he must provide the water user with an annual notice that a test is due, along with a report form for the test results. The notice should give the following:

1. The service location and account number (or other appropriate identification number).
2. A statement of who is responsible for routine maintenance, repair, and testing.
3. The authority under which the testing requirement is made (i.e., state regulation and utility ordinance or rules).
4. The date by which the assembly must be tested (and repaired if necessary); generally a 30 or 60 day period.
5. The consequences of failure to test or repair an assembly (i.e., termination of water service).
6. The contact person at the utility, including address and phone number.
7. A report form for the water user to submit the test results.
8. A list of certified or approved assembly testers; or if the utility carries out all testing, a statement concerning the charges for testing and the responsibility for repair of malfunctioning assemblies.

VII - 1
C. **List of Certified Testers**

If the water supplier does not assume the responsibility for testing the backflow prevention assemblies in his system, he must make sure that his customers retain approved testers to perform the task. To accomplish this, the water supplier must provide his customers with a list of persons that have demonstrated their competence in testing these assemblies.

AWWA, as well as several counties, have lists of testers certified under their programs. Copies of these lists may be obtained from these agencies.

D. **Follow-up**

The water supplier needs to verify that testing has been done, reports submitted, and repairs made, within the period allowed. Enforcement procedures that should precede termination of water service are discussed in Section IX. Backflow prevention assemblies that need frequent repair should be tested more often than annually.

E. **Testing Procedures**

The various types of backflow prevention assemblies require different equipment and procedures for testing the operation of the assembly. RFs are tested using a differential pressure gage. DCs can be tested using a set of calibrated Bourdon tube gages, a calibrated duplex gage, or pressure transducers. Those users providing air gap protection must be required to have these plumbing arrangements inspected annually to verify that the air gap is in still in place, and that it has not been bypassed.

Backflow prevention assemblies must be tested using approved procedures; i.e., the procedure used by the testing organization that tested and approved the assembly. Approved testing procedures are included in Appendix E.
Chapter VIII. MAINTENANCE OF RECORDS

A. Contents

The water supplier must maintain up-to-date records to effectively manage a cross connection control program. If he contracts with another agency to implement his program, the water supplier must keep an up-to-date copy of his system's records to be able to respond to emergencies. The records should include the following information for each backflow prevention assembly in the water system:

1. Identification information
   Name
   Address
   Account number (or other identification number)
   Responsible person
   Type of business

2. The date of the most recent cross connection survey performed at this location

3. Type of hazard(s)

4. Location of assembly

5. Type of assembly; including make, model, size, serial number, recommended frequency of testing

6. Record of testing and repairs

7. Comments, notes on any problems with the assembly (e.g., repeated failures to pass tests)

Records should also be kept on surveys made of premises where no backflow protection was required.

B. Evaluation

The water supplier must evaluate the information he receives. He should make sure that the assembly passed the test, and note if any repairs were necessary to enable the device to pass. If a device frequently needs repairs, it indicates that either the device or the tester is not performing adequately. The water supplier should follow up on such observations by checking the records on other installations of the same assembly in his system, and by checking other reports submitted by the tester in question. If his own records are inadequate, the supplier should consult with other water suppliers or the health agency. Any apparent failures of either assemblies or testers to perform adequately should be reported to the health agency. A water
supplier should set up his records to facilitate such investigations.

C. Formats for Record Systems

Records can be kept using either a manual system or a computerized system. A sample form that can be used to record this information is included in Appendix D.
Chapter IX. ENFORCEMENT

A. Conditions Leading to Termination of Water Service

If the need arises, a water supplier must be prepared to terminate water service to a user until an identified backflow hazard has been properly isolated. When water uses are found that pose a clear and immediate hazard to the potable water supply and these hazards cannot be abated at once, the water supplier should terminate service to the premises until the hazards are abated. Conditions requiring immediate action include the following:

1. Direct or indirect connection between a potable water system and a sewer line.

2. Unprotected direct or indirect connection between a potable water system and a system or equipment containing toxic chemicals or sewage.

3. Unprotected direct or indirect connection between potable water systems and auxiliary water systems.

When these situations are encountered, the water supplier must see that the problem is corrected immediately, or terminate water service until corrections are made.

Other conditions that require water service termination include, but are not limited to, the following:

1. Unprotected direct connection between potable water system and any nonpotable system.

2. Refusal to test a backflow prevention assembly.

3. Refusal to repair or, if necessary, to replace a faulty backflow prevention assembly.

4. Refusal to correct violations.

These violations should be dealt with in a timely manner. The procedures described in the following sections apply to these situations.

B. Water User Notification

Water suppliers should notify their users of the results of the cross connection survey as described in Chapter IV. If the customer fails to respond or refuses to comply within the
given deadlines, the water supplier should follow up with a second notice. This notice should include the following:

1. a reiteration of the cross connection hazards found on the user's premises, and the required corrective actions.

2. a second deadline for either correcting the problem or scheduling an office hearing to explain why the requirements should be postponed or eliminated.

3. a statement of the supplier's intention to terminate water service to the user's premises should he fail to comply with the new deadline.

4. information regarding the extra charges the user will have to pay to reestablish water service after it is terminated.

C. Office Hearing

The water supplier should arrange an office hearing at the water user's request. The participants in the hearing will typically include the customer or his representative, the water supplier's cross connection program manager, and the inspector that made the survey of the user's premises. Additional participants may include the program manager's supervisor and a health agency representative.

The purpose of the hearing is to allow the water user to present his arguments against complying with either the directives or the schedule given in the water suppliers notice. The person or persons that will render the final decision should be identified at the outset of the meeting, and should be familiar with cross connection practices and procedures. Because the responsibility for the decision rests upon the water supplier or his agent, the health agency representative should only act in an advisory capacity unless it has contracted with the water supplier to manage his cross connection program.

The office hearing should result in a clear directive to the water user of the corrective actions, if any, that he must take and a schedule for compliance. This should be confirmed in writing by the water supplier within five days. Should the user fail to comply the water supplier may, as appropriate, either schedule another hearing or terminate water service to the user's premises.

D. Termination of Water Service

If the procedures described above fail to prompt corrective action from the water user, the water supplier should terminate
water service to the premises. In doing so, the following steps should be taken:

1. The water supplier should make a reasonable effort to advise the user when his water service will be terminated. If the premises is occupied by a tenant, both the owner and the tenant should be notified.

2. The water supplier should advise the health agency of pending water service termination.

The water supplier must ensure that the service connection remains inactive until the user has corrected the cross connection hazards. This may require the removal of a section of the service line to the user's premises, or frequent inspections to verify that the service is inactive. The water supplier must inspect the user's facilities to make sure that all corrections have been made before reactivating the water service.
REVISION RECORD FOR REGISTER 87, No. 23  
(June 6, 1987)

TITLE 17. PUBLIC HEALTH

PART I. DEPARTMENT OF HEALTH SERVICES

This part of Register 87, No. 23, contains all the additions, amendments, and repeals affecting the above-entitled portion of the California Administrative Code which were filed with the Secretary of State from 5-30-87, to and including 6-6-87. The latest prior register containing regulations of the above agency is Register 87, No. 11 (3-14-87).

It is suggested that the section numbers listed below as well as the page numbers be checked when inserting this material in the code and removing the superseded material. In case of doubt rely upon the section numbers rather than the page numbers since the section numbers must run consecutively. It is further suggested that superseded material be retained with this revision record sheet so that the prior wording of any section can be easily ascertained.

SECTION CHANGES

Unless otherwise noted, the sections listed below are amended herein.

| T17-7583 Repealed        |
| 7583-7586 Added          |
| T17-7588-T17-7594 Repealed |
| 7601-7605 Added          |
| T17-7603-T17-7605 Repealed |
| T17-7615-T17-7622 Repealed |

PAGE CHANGES

<table>
<thead>
<tr>
<th>Remove Old Pages</th>
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<tr>
<td>150.1-150.2</td>
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(Precedes page 150.1, Title 17)
GROUP 4. DRINKING WATER SUPPLIES

DETAILED ANALYSIS

Article 1. General

Section
7583. Definitions
7584. Responsibility and Scope of Program
7585. Evaluation of Hazard
7586. User Supervisor

Article 2. Protection of Water System

Section
7601. Approval of Back Flow Preventers
7602. Construction of Backflow Preventers
7603. Location of Backflow Preventers
7604. Type of Protection Required
7605. Testing and Maintenance of Backflow Preventers

Article 5. Domestic Water Supply Reservoirs

Section
7623. Intent of Regulations
7624. Application of Regulations
7625. Definitions
7626. Application for Permit
7627. Data to Accompany Application
7628. Guides to Evaluating Application
7629. Reservoirs for Which Permits May Be Granted
7630. Kinds of Recreational Use Allowed or Prohibited
Article 1. General

7583. Definitions.
In addition to the definitions in Section 4010.1 of the Health and Safety Code, the following terms are defined for the purpose of this Chapter:
(a) "Approved Water Supply" is a water supply whose potability is regulated by a State or local health agency.
(b) "Auxiliary Water Supply" is any water supply other than that received from a public water system.
(c) "Air-gap Separation (AG)" is a physical break between the supply line and a receiving vessel.
(d) "AWWA Standard" is an official standard developed and approved by the American Water Works Association (AWWA).
(e) "Cross-connection" is an unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur, shall be considered to be cross-connections.
(f) "Double Check Valve Assembly (DC)" is an assembly of at least two independently acting check valves including tightly closing shut-off valves on each side of the check valve assembly and test cocks available for testing the watertightness of each check valve.
(g) "Health Agency" means the California Department of Health Services, or the local health officer with respect to a small water system.
(h) "Local Health Agency" means the county or city health authority.
(i) "Reclaimed Water" is a wastewater which as a result of treatment is suitable for uses other than potable use.
(j) "Reduced Pressure Principle Backflow Prevention Device (RP)" is a backflow preventer incorporating not less than two check valves, an automatically operated differential relief valve located between the two check valves, a tightly closing shut-off valve on each side of the check valve assembly, and equipped with necessary test cocks for testing.
(k) "User Connection" is the point of connection of a user's piping to the water supplier's facilities.
(l) "Water Supplier" is the person who owns or operates the public water system.
(m) "Water User" is any person obtaining water from a public water supply.


HISTORY:
1. Repealer of Articles 1 through 10 and New Articles 1 through 4 (Sections 7583, 7588 through 7594, 7603 through 7605, and 7615 through 7622) filed 5-9-53; effective thirtieth day thereafter (Register 53, No. 8).
2. New section filed 5-26-87; operative 6-25-87 (Register 87, No. 23).

T17-7583. Purpose.


HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 23).
§ 7584  DRINKING WATER SUPPLIES  TITLE 17

(p. 152)

(Register 87, No. 23—6-6-87)

7584. Responsibility and Scope of Program.

The water supplier shall protect the public water supply from contamination by implementation of a cross-connection control program. The program, or any portion thereof, may be implemented directly by the water supplier or by means of a contract with the local health agency, or with another agency approved by the health agency. The water supplier's cross-connection control program shall for the purpose of addressing the requirements of Sections 7585 through 7605 include, but not be limited to, the following elements:

(a) The adoption of operating rules or ordinances to implement the cross-connection program.

(b) The conducting of surveys to identify water user premises where cross-connections are likely to occur,

(c) The provisions of backflow protection by the water user at the user's connection or within the user's premises or both,

(d) The provision of at least one person trained in cross-connection control to carry out the cross-connection program,

(e) The establishment of a procedure or system for testing backflow preventers, and

(f) The maintenance of records of locations, tests, and repairs of backflow preventers.


HISTORY:
1. New section filed 5-26-87; operative 6-25-87 (Register 87, No. 23).


The water supplier shall evaluate the degree of potential health hazard to the public water supply which may be created as a result of conditions existing on a user's premises. The water supplier, however, shall not be responsible for abatement of cross-connections which may exist within a user's premises. As a minimum, the evaluation should consider: the existence of cross-connections, the nature of materials handled on the property, the probability of a backflow occurring, the degree of piping system complexity and the potential for piping system modification. Special consideration shall be given to the premises of the following types of water users:

(a) Premises where substances harmful to health are handled under pressure in a manner which could permit their entry into the public water system. This includes chemical or biological process waters and water from public water supplies which have deteriorated in sanitary quality.

(b) Premises having an auxiliary water supply, unless the auxiliary supply is accepted as an additional source by the water supplier and is approved by the health agency.

(c) Premises that have internal cross-connections that are not abated to the satisfaction of the water supplier or the health agency.

(d) Premises where cross-connections are likely to occur and entry is restricted so that cross-connection inspections cannot be made with sufficient frequency or at sufficiently short notice to assure that cross-connections do not exist.

(e) Premises having a repeated history of cross-connections being established or re-established.


HISTORY:
1. New section filed 5-26-87; operative 6-25-87 (Register 87, No. 23).
7586. User Supervisor.
   The health agency and water supplier may, at their
   industrial water user to designate a user supervisor vi
   premises has a multipiping system that has various t
   which may be hazardous and where changes in the pipin
   made. The user supervisor shall be responsible for t
   connections during the installation, operation and main
   user's pipelines and equipment.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. New section filed 5-26-87; operative 6-25-87 (Register 87, 5
T17-7588. Cross-connection.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 2
T17-7589. Approved Water Supply.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 2
T17-7590. Auxiliary Supply.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 2
T17-7591. Approved Check Valve.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 2
T17-7592. Approved Double Check Valve Assembly.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 2
T17-7593. Air-gap Separation.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 2
T17-7594. Approved Reduced Pressure Principle Backfl
vice.
NOTE: Authority cited: Sections 208 and 4026, Health and Safet
HISTORY:
1. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 2
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Article 2. Protection of Water System

7601. Approval of Backflow Preventers.
Backflow preventers required by this Chapter shall have passed laboratory and field evaluation tests performed by a recognized testing organization which has demonstrated their competency to perform such tests to the Department.


HISTORY:
1. New section filed 5-25-87; operative 6-25-87 (Register 87, No. 23).

7602. Construction of Backflow Preventers.
(a) Air-gap Separation. An Air-gap separation (AG) shall be at least double the diameter of the supply pipe, measured vertically from the flood rim of the receiving vessel to the supply pipe; however, in no case shall this separation be less than one inch.

(b) Double Check Valve Assembly. A required double check valve assembly (DC) shall, as a minimum, conform to the AWWA Standard C506-78 (R83) adopted on January 28, 1978 for Double Check Valve Type Backflow Preventive Devices which is herein incorporated by reference.

(c) Reduced Pressure Principle Backflow Prevention Device. A required reduced pressure principle backflow prevention device (RP) shall, as a minimum, conform to the AWWA Standard C506-78 (R83) adopted on January 28, 1978 for Reduced Pressure Principle Type Backflow Prevention Devices which is herein incorporated by reference.


HISTORY:
1. New section filed 5-25-87; operative 6-25-87 (Register 87, No. 23).

7603. Location of Backflow Preventers.
(a) Air-gap Separation. An air-gap separation shall be located as close as practical to the user’s connection and all piping between the user’s connection and the receiving tank shall be entirely visible unless otherwise approved in writing by the water supplier and the health agency.

(b) Double Check Valve Assembly. A double check valve assembly shall be located as close as practical to the user’s connection and shall be installed above grade, if possible, and in a manner where it is readily accessible for testing and maintenance.

(c) Reduced Pressure Principle Backflow Prevention Device. A reduced pressure principle backflow prevention device shall be located as close as practical to the user’s connection and shall be installed a minimum of twelve inches (12") above grade and not more than thirty-six inches (36") above grade measured from the bottom of the device and with a minimum of twelve inches (12") side clearance.


HISTORY:
1. New section filed 5-25-87; operative 6-25-87 (Register 87, No. 23).
7604. Type of Protection Required.

The type of protection that shall be provided to prevent backflow into the public water supply shall be commensurate with the degree of hazard that exists on the consumer’s premises. The type of protective device that may be required (listed in an increasing level of protection) includes: Double Check Valve Assembly—(DC), Reduced Pressure Principle Backflow Prevention Device—(RP), and an Air-gap Separation—(AG). The water user may choose a higher level of protection than required by the water supplier. The minimum types of backflow protection required to protect the public water supply, at the water user’s connection to premises with various degrees of hazard are given in Table 1. Situations which are not covered in Table 1 shall be evaluated on a case-by-case basis and the appropriate backflow protection shall be determined by the water supplier or health agency.

**TABLE 1**

**TYPE OF BACKFLOW PROTECTION REQUIRED**

<table>
<thead>
<tr>
<th>Degree of Hazard</th>
<th>Minimum Type of Backflow Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Sewage and Hazardous Substances</td>
<td></td>
</tr>
<tr>
<td>(1) Premises where the public water system is used to supplement the reclaimed water supply.</td>
<td>AG</td>
</tr>
<tr>
<td>(2) Premises where there are wastewater pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.</td>
<td>AG</td>
</tr>
<tr>
<td>(3) Premises where reclaimed water is used and there is no interconnection with the potable water system. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.</td>
<td>AG</td>
</tr>
<tr>
<td>(4) Premises where hazardous substances are handled in any manner in which the substances may enter the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.</td>
<td>AG</td>
</tr>
<tr>
<td>(5) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected.</td>
<td>RP</td>
</tr>
<tr>
<td>(b) Auxiliary Water Supplies</td>
<td></td>
</tr>
<tr>
<td>(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and water supplier.</td>
<td>AG</td>
</tr>
<tr>
<td>(2) Premises where there is an unapproved auxiliary water supply and there are no interconnections with the public water system. A DC may be provided in lieu of a RP if approved by the health agency and water supplier.</td>
<td>RP</td>
</tr>
<tr>
<td>(c) Fire Protection Systems</td>
<td></td>
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<tr>
<td>(1) Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected).</td>
<td>DC</td>
</tr>
</tbody>
</table>
§ 7605  
DRINKING WATER SUPPLIES  

(p. 152.4)  

(2) Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and water supplier. 

(3) Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from private reservoirs or tanks are used. 

(d) Dockside Watering Points and Marine Facilities 
(1) Pier hydrants for supplying water to vessels for any purpose. 
(2) Premises where there are marine facilities. 
(e) Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that cross-connections do not exist. 

(f) Premises where there is a repeated history of cross-connections being established or re-established. 


HISTORY: 
1. New section filed 5-26-87; operative 6-25-87 (Register 87, No. 23). 

7605. Testing and Maintenance of Backflow Preventers. 
(a) The water supplier shall assure that adequate maintenance and periodic testing are provided by the water user to ensure their proper operation. 
(b) Backflow preventers shall be tested by persons who have demonstrated their competency in testing of these devices to the water supplier or health agency. 
(c) Backflow preventers shall be tested at least annually or more frequently if determined to be necessary by the health agency or water supplier. When devices are found to be defective, they shall be repaired or replaced in accordance with the provisions of this Chapter. 
(d) Backflow preventers shall be tested immediately after they are installed, relocated or repaired and not placed in service unless they are functioning as required. 
(e) The water supplier shall notify the water user when testing of backflow preventers is needed. The notice shall contain the date when the test must be completed. 
(f) Reports of testing and maintenance shall be maintained by the water supplier for a minimum of three years. 


HISTORY: 
1. Repealer and new section filed 5-26-87; operative 6-25-87 (Register 87, No. 23). 

Article 3. Protection of Public Water System at Service Connection 

T17-7603. Where Protection Is Required. 


HISTORY: 
1. Amendment filed 3-5-71; effective thirtieth day thereafter. Approved by State Building Standards Commission 2-26-71 (Register 71, No. 10). 
2. Repealer filed 5-26-87; operative 6-25-87 (Register 87, No. 23).
4017. Any person who operates a public water system shall do all of the following:

(a) Comply with primary and secondary drinking water standards.

(b) Ensure that the system will not be subject to backflow under normal operating conditions.

(c) Provide a reliable and adequate supply of pure, wholesome, healthful, and potable water.

Excerpt from California Waterworks Standards: California Code of Regulations, Title 22, Chapter 16

64566. System Pressure

(a) Changes in distribution system pressure shall be designed an operating service pressure at all service connections of not less than 20 pounds per square inch guage (psig) (140 kiloPascals guage (kPag)) under the following demand conditions:

(1) User maximum hour demand

(2) User average day demand plus design fire flow

(b) In a public water system supplying users at widely varying elevations, a water supplier may furnish a service to a user which does not comply with (a) if the user is fully advised of the conditions under which minimum service may be expected and the user’s agreement is secured in writing. This waiver shall be applicable only to individual service connections.

(c) Water mains shall be designed to have at least five psig (35 kPag) pressure throughout any buried length of the main except when the main is removed from service for repairs or maintenance. This requirement shall not apply to short lengths of water main near reservoir inlets and outlets provided:

(1) The water main is on premises owned, leased or controlled by the water supplier; or

(2) The prior review and written approval of the Department is obtained.

December 10, 1984

Local Fire Department and Fire Districts
Local Health Agencies
Public Water System Operators

RE: Cross-Connection Control Requirements on Certain Classes of Fire Sprinkler Systems - AB 2503

(This Bulletin replaces the State Fire Marshal’s Bulletin dated November 30, 1983 and the letter of the Department of Health Services dated December 9, 1983).

Attachment A is a copy of Assembly Bill 2503 (Section 13114.7 of the Health and Safety Code). The objective of the bill is to provide reasonable backflow protection to the domestic water utility without installation of redundant devices on fire protection systems by either the public water supplier or local health agencies. AB 2503 defines Class 1 and 2 fire systems as they are defined in Section 6.3 of the American Water Works Association’s (AWWA) Manual M-14. Further provisions in Section 6.3 state: "Generally, fire protection systems of Classes 1 and 2 will not require backflow protection at the service connection. Pumper connections of automotive fire department equipment to street hydrants are not ordinarily health hazards."

AB 2503 definitions of Classes 1 and 2 fire protection systems are interpreted to refer to those systems which generally and ordinarily would not require an approved backflow protection device at the fire system user connection in order to protect the public water system. However, it is recognized that "special conditions" may exist on the site of a Class 1 or 2 fire sprinkler system such that an actual or potential contamination hazard is presented to the domestic water supply and that under these "special conditions" an approved backflow prevention device, at the user connection for the fire sprinkler system, is warranted. Attachment B presents examples of "special conditions" which may exist on a premise. Where such conditions exist or are suspected, the representatives of the local water utility and the local fire department should investigate and evaluate the premises to determine whether an approved backflow prevention device is warranted and should be required at the user connection. If the fire and water representatives do not agree, the matter shall be further reviewed with designated representatives of the Department of Health Services. If agreement is not reached at this level, the State Fire Marshal shall make the final determination of the requirements. Attachment C is a copy of Assembly Bill 921 (Section 11342.3 of the Government Code) covering the authority of the State Fire Marshal.

Note that Class 1 and 2 fire sprinkler systems are served only from potable water mains. Chemicals, additives or water from unapproved sources (non-potable) shall not be introduced into these systems. If fire sprinkler systems are to be in categories of Classes 1 and 2, it is
necessary for the local fire chief to conform with the policy of the State Fire Marshal in that the use of fire department pumping equipment will neither introduce chemicals into the fire sprinkler system nor draft from unapproved water sources. Fire Departments introducing chemicals, additives or connecting to unapproved water supplies through the fire department connections on Class 1 and 2 fire sprinkler systems shall bear both the responsibility and liability resulting from any domestic water supply contamination that occurs from such action.

RONALD W. BOGARDUS, P.E.
State Fire Marshal

PETER RANK, Director
California Department of Health Services

Attachments
FIRE PROTECTION—AUTOMATIC FIRE SPRINKLER SYSTEMS
Assembly Bill No. 2503

CHAPTER 425

An act to add Section 13114.7 to the Health and Safety Code, relating to fire protection.

[Approved by Governor July 7, 1982. Filed with Secretary of State July 8, 1982.]

LEGISLATIVE COUNSEL'S DIGEST

AB 2503, Lancaster. Fire protection: automatic fire sprinkler systems.

(1) Existing law does not define class I and class II automatic fire sprinkler systems.

This bill would define those classes of automatic fire sprinkler systems, as prescribed.

(2) Article XIII B of the California Constitution and Sections 2231 and 2234 of the Revenue and Taxation Code require the state to reimburse local agencies and school districts for certain costs mandated by the state. Other provisions require the Department of Finance to review statutes disclaiming these costs and provide, in certain cases, for making claims to the State Board of Control for reimbursement.

However, this bill would provide that no appropriation is made and no reimbursement is required by this act for a specified reason.

The people of the State of California do enact as follows:

SECTION 1. Section 13114.7 is added to the Health and Safety Code, to read:

13114.7. (a) For the purposes of this section the following are definitions of class I and class II systems:

(1) American Water Works Association (A.W.W.A.) Manual No. M-14 class I—Automatic fire sprinkler systems with direct connection from public water mains only; no pumps, tanks, or reservoirs; no physical connection from other water supplies; no antifreeze or additives of any kind; and all sprinkler drains discharging to the atmosphere or other safe outlets.

(2) American Water Works Association (A.W.W.A.) Manual No. M-14 class II—Automatic fire sprinkler systems which are the same as class I, except that booster pumps may be installed in the connections from the street mains.

(b) Automatic fire sprinkler systems described in subdivision (a) shall not require any backflow protection equipment at the service connection other than required by standards for those systems contained in the publication of the National Fire Protection Association entitled "Installation of Sprinkler Systems" (N.F.P.A. Pamphlet No. 13, 1980 edition).

SEC. 2. No appropriation is made and no reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution or Section 2231 or 2234 of the Revenue and Taxation Code because the only costs which may be incurred by a local agency or school district will be incurred because this act creates a new crime or infraction, changes the definition of a crime or infraction, changes the penalty for a crime or infraction, or eliminates a crime or infraction.

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Attachment B

EXAMPLES OF "SPECIAL CONDITIONS" THAT MAY WARRANT
APPROVED BACKFLOW PREVENTION DEVICES AT THE USER CONNECTION
OF CLASS 1 AND CLASS 2 FIRE SPRINKLER SYSTEMS

1. Underground fire sprinkler pipe lines parallel to and within ten
   feet horizontally of sewer pipe lines or other pipe lines
   carrying significantly toxic materials.

2. When water is supplied to a site or an area from two or more
   services of a water utility, or from two different water
   utilities, flow problems should be evaluated.

3. Occupancies (or changes in occupancies) which involve the use,
   storage, or handling of types and quantities of materials in a
   manner which could present a significant health hazard to the
   domestic water supply.

4. Premises with unusually complex piping systems (usually these
   premises will have an approved backflow prevention device on
   their domestic service piping).
Attachment C

Assembly Bill No. 921

CHAPTER 1177

An act to add Section 11342.3 to the Government Code, and to amend Sections 12531, 17920.7, 17921, and 18830 of, and to amend, repeal, and add Section 12530 of, and to add Section 12538 to, the Health and Safety Code, relating to fire and panic safety.

[Approved by Governor October 1, 1981. Filed with Secretary of State October 2, 1981.]

LEGISLATIVE COUNSEL'S DIGEST

AB 921, Vicencio. Fire and panic safety: regulations.

(1) Under existing law, state agencies may adopt rules and regulations to interpret and make specific the programs administered by them, including the Commission of Housing and Community Development and the State Fire Marshal.

This bill would expressly restrict the authority of the commission to adopt regulations relating to fire and panic safety and, instead, require those regulations be adopted by the State Fire Marshal. The bill would, with specified exceptions, also make any regulation adopted, amended, or repealed, which is filed with the Office of Administrative Law and the Secretary of State and intended to promote fire and panic safety, valid and effective only if adopted or approved in writing by the State Fire Marshal. The bill would provide that the regulations existing on the effective date of the bill would remain in effect until amended, repealed, or superseded by regulations adopted by the State Fire Marshal.

The people of the State of California do enact as follows:

SECTION 1. Section 11342.3 is added to the Government Code, to read:

11342.3. (a) Except as provided in subdivision (b), on and after January 1, 1982, no new regulation, or the amendment or repeal of any regulation, which regulation is intended to promote fire and panic safety or provide fire protection and prevention, including fire suppression systems, equipment, or alarm regulation, is valid or effective unless it is submitted by, or approved in writing by, the State Fire Marshal before transmittal to the Secretary of State or the Office of Administrative Law.

(b) Approval of the State Fire Marshal is not required if the regulation is expressly required to be at least as effective as federal standards published in the Federal Register pursuant to Section 6 of the Occupational Safety and Health Act of 1970 (P.L. 91-596) within the time period specified by federal law and as provided in subdivision (b) of Section 142.4 of the Labor Code, and as approved by the Occupational Safety and Health Administration of the United States Department of Labor as meeting the requirements of subdivision (a) of Section 142.3 of the Labor Code, unless the regulation is determined by the State Fire Marshal to be less effective in promoting fire and panic safety than regulations adopted by the State Fire Marshal.

A-14
introduced by senator BERGESEN

march 2, 1987

An act to add chapter 7.9 (commencing with section 4049.50) to part 1 of division 5 of the health and safety code, relating to water supply.

LEGISLATIVE COUNSEL'S DIGEST

SB 784, as amended, BERGESEN. Water supply: cross-connections.
Existing law does not specifically provide for programs by local health officers for control of cross-connections by water users.

This bill would authorize local health officers to maintain programs for control of cross-connections by water users, within the users' premises, where public exposure to drinking water contaminated by backflow may occur, prescribe what the programs may include, and authorize the local health officer to collect fees from those water users required to install backflow prevention devices to offset the costs of implementing cross-connection control programs.

The bill would also authorize local health officers to maintain programs, in cooperation with water suppliers, to protect the public water supply against backflow through service connections, and authorize the local health officers to collect fees from those water users required to install backflow prevention devices to offset the administrative costs of these programs.

State-mandated local program: no.

The people of the State of California do enact as follows:

SECTION 1. Chapter 7.9 (commencing with Section 4049.50) is added to Part 1 of Division 5 of the Health and Safety Code, to read:

CHAPTER 7.9. CONTROL OF CROSS-CONNECTIONS BY WATER USERS

4049.50. Local health officers may maintain programs for the control of cross-connections by water users, within the users' premises, where public exposure to drinking water contaminated by backflow may occur. The programs may include inspections within water users' premises for the purpose of identifying cross-connection hazards and determining appropriate backflow protection. Water users shall comply with all orders, instructions, regulations, and notices from the local health officer with respect to the installation, testing, and maintenance of backflow prevention devices. The local health officer may collect fees from those water users required to install backflow prevention devices to offset the costs of implementing cross-connection control programs.

4049.51. Local health officers may maintain programs, in cooperation with water suppliers, to protect against backflow through service connections into the public water supply, and may collect fees from those water users required to install backflow prevention devices to offset the costs of implementing these programs. The fees authorized under this section and under Section 4049.50 shall be limited to the costs of administering these programs. These programs shall be conducted in accordance with backflow protection regulations adopted by the State Department of Health Services.*

*The bill was amended to include this sentence on July 16, 1987.
AN ORDINANCE OF THE INSTITUTING A CROSS-CONNECTION CONTROL PROGRAM TO PROTECT THE PUBLIC WATER SYSTEM

THE FOLLOWS:

DOES ORDAIN AS

SECTION I - PURPOSE

The purpose of this ordinance is (1) to protect the public water supply against actual or potential contamination through cross connections by isolating sources of contamination that may occur within a water user's premises because of some undiscovered or unauthorized cross connection on the premises; (2) to eliminate existing connections between drinking water systems and other sources of water that are not approved as safe and potable for human consumption; (3) to eliminate cross-connections between drinking water systems and sources of contamination; (4) to prevent the making of cross-connections in the future.

These regulations are adopted pursuant to the State of California Administrative Code, Title 17 - Public Health entitled "Regulations Relating to Cross-Connections".

It is unlawful for any person, firm, or corporation at any time to make or maintain or cause to be made or maintained, temporarily or permanently, for any period of time whatsoever, any cross-connection between plumbing pipes or water fixtures being served with water by the City/District water department and any other source of water supply or to maintain any sanitary fixture or other appurtenances or fixtures which, by reason of their construction, may cause or allow backflow of water or other substances into the water supply system of the City/District and/or the service of water pipes or fixtures of any consumer of the City/District.

SECTION I - DEFINITIONS

A. Air-Gap Separation: The term "air-gap separation" means a physical break between a supply pipe and a receiving vessel. The air-gap shall be at least double the diameter of the supply pipe measured vertically above the top rim of the vessel, in no case less than one inch.

B. Approved Backflow Prevention Assembly: The term "Approved backflow prevention assembly" shall mean an assembly which has passed laboratory and field evaluation tests performed by a recognized testing organization which has demonstrated their competency to perform such tests to the California Department of Health Services.

C. Approved Water Supply: The term "approved water supply" means any water supply whose potability is regulated by a State or local health agency.
APPENDIX B: SAMPLE CROSS CONNECTION CONTROL ORDINANCES
D. **Auxiliary Supply:** The term "auxiliary supply" means any water supply on or available to the premises other than the approved water supply.

E. **AWWA Standard:** The term "AWWA Standard" means an official standard developed and approved by the American Water Works Association (AWWA).

F. **Backflow:** The term "backflow" shall mean a flow condition, caused by a differential in pressure, that causes the flow of water or other liquids, gases, mixtures or substances into the distributing pipes of a potable supply of water from any source or sources other than an approved water supply source. Backsiphonage is one cause of backflow. Back pressure is the other cause.

G. **Contamination:** The term "contamination" means a degradation of the quality of the potable water by any foreign substance which creates a hazard to the public health, or which may impair the usefulness or quality of the water.

H. **Cross-Connection:** The term "cross-connection" as used in this Ordinance means any unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or changeover assemblies, or other assemblies through which backflow could occur, shall be considered to be cross-connections.

I. **Double Check Valve Assembly:** The term "double check valve assembly" means an assembly of two internally loaded, independently acting check valves, including resilient seated shut-off valves on each end of the assembly and test cocks for testing the watertightness of each check valve.

J. **Health Agency:** The term "health agency" means the California Department of Health Services, or the local health agency with respect to a small water system.

K. **Local Health Agency:** The term "local health agency" means the county or city health authority.

L. **Person:** The term "person" means an individual, corporation, company, association, partnership, municipality, public utility, or other public body or institution.
M. **Premises:** The term "premises" means any and all areas on a water user’s property which are served or have the potential to be served by the public water system.

N. **Public Water System:** The term "public water system" means a system for the provision of piped water to the public for human consumption that has five or more service connections or regularly serves an average of 25 individuals daily at least 60 days out of the year.

O. **Reclaimed Water:** The term "reclaimed water" means a wastewater which, as a result of treatment, is suitable for uses other than potable use.

P. **Reduced Pressure Principle Backflow Prevention Assembly:** The term "reduced pressure principle backflow prevention assembly" means an assembly incorporating two internally loaded, independently operating check valves and an automatically operating differential relief valve located between the two checks, including resilient seated shut-off valves on each end of the assembly, and equipped with necessary test cocks for testing the assembly.

Q. **Service Connection:** The term "service connection" refers to the point of connection of a user’s piping to the water supplier’s facilities.

R. **Water Supplier:** The term "water supplier" means the person who owns or operates the approved water supply system.

S. **Water User:** The term "water user" means any person obtaining water from a approved water supply system.

**SECTION III - CROSS-CONNECTION PROTECTION REQUIREMENTS**

A. **General Provisions**

1. Unprotected cross-connections with the public water supply are prohibited.

2. Whenever backflow protection has been found necessary, the City/District will require the water user to install an approved backflow prevention assembly by and at his expense for continued services or before a new service will be granted.

3. Wherever backflow protection has been found necessary on a water supply line entering a water user’s premises, then any and all water supply lines from the City’s/District’s mains entering such premises, buildings, or structures shall be protected by an
approved backflow prevention assembly. The type of assembly to be installed will be in accordance with the requirements of this ordinance.

B. Where Protection is Required

1. Each service connection from the City/District water system for supplying water to premises having an auxiliary water supply shall be protected against backflow of water from the premises into the public water system unless the auxiliary water supply is accepted as an additional source by the City/District, and is approved by the public health agency having jurisdiction.

2. Each service connection from the City/District water system for supplying water to any premises on which any substance is handled in such fashion as may allow its entry into the water system shall be protected against backflow of the water from the premises into the public system. This shall include the handling of process waters and waters originating from the City/District water system which have been subjected to deterioration in sanitary quality.

3. Backflow prevention assemblies shall be installed on the service connection to any premises having (a) internal cross-connections that cannot be permanently corrected and controlled to the satisfaction of the state or local health department and the City/District, or (b) intricate plumbing and piping arrangements or where entry to all portions of the premises is not readily accessible for inspection purposes, making it impracticable or impossible to ascertain whether or not cross-connections exist.

C. Type of Protection Required

1. The type of protection that shall be provided to prevent backflow into the approved water supply shall commensurate with the degree of hazard that exists on the consumer’s premises. The type of protective assembly that may be required (listing in an increasing level of protection) includes: Double Check Valve Assembly (DC), Reduced Pressure Principle Backflow Prevention Assembly (RP), and an Air-gap separation (AG). The water user may choose a higher level of protection than required by the City/District. The minimum types of backflow protection required to protect the approved water supply, at the user’s water connection to premises with varying degrees of hazard are given in Table 1. Situations which are not covered in Table 1 shall be evaluated on a case by case basis and the appropriate backflow protection shall be determined by the City/District or health agency.
Table 1
TYPE OF BACKFLOW PROTECTION REQUIRED

<table>
<thead>
<tr>
<th>Degree of Hazard</th>
<th>Minimum Type of Backflow Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Sewage and Hazardous Substances</td>
<td></td>
</tr>
<tr>
<td>(1) Premises where the public water system is used to supplement the reclaimed water supply.</td>
<td>AG</td>
</tr>
<tr>
<td>(2) Premises where there are wastewater pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and the City/District.</td>
<td>AG</td>
</tr>
<tr>
<td>(3) Premises where reclaimed water is used and there is no interconnection with the potable water system. A RP may be provided in lieu of an AG if approved by the health agency and the City/District.</td>
<td>AG</td>
</tr>
<tr>
<td>(4) Premises where hazardous substances are handled in any manner in which the substances may enter a potable water system. This does not include a single family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and the City/District.</td>
<td>AG</td>
</tr>
<tr>
<td>(5) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected.</td>
<td>RP</td>
</tr>
<tr>
<td>(b) Auxiliary Water Supplies</td>
<td></td>
</tr>
<tr>
<td>(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and the City/District.</td>
<td>AG</td>
</tr>
<tr>
<td>(2) Premises where there is an unapproved auxiliary water supply and there are no interconnections with the public water system. A DC may be provided in lieu of a RP if approved by the health agency and City/District.</td>
<td>RP</td>
</tr>
<tr>
<td>Degree of Hazard</td>
<td>Minimum Type of Backflow Prevention</td>
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</table>

(c) Fire Protection Systems

(1) Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected). DC

(2) Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and City/District. AG

(3) Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from the private reservoirs or tanks are used. DC

(d) Dockside Watering Points and Marine Facilities

(1) Pier hydrants for supplying water to vessels for any purpose. RP

(2) Premises where there are marine facilities. RP

(e) Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that cross-connections do not exist. RP

(f) Premises where there is a repeated history of cross-connections being established or re-established. RP
2. Two or more services supplying water from different street mains to the same building, structure, or premises through which an interstreet main flow may occur, shall have at least a standard check valve on each water service to be located adjacent to and on the property side of the respective meters. Such check valve shall not be considered adequate if backflow protection is deemed necessary to protect the City’s/District’s mains from pollution or contamination; in such cases the installation of approved backflow assemblies at such service connections shall be required.

SECTION IV - BACKFLOW PREVENTION ASSEMBLIES

A. Approved Backflow Prevention Assemblies

1. Only backflow prevention assemblies which have been approved by the City/District shall be acceptable for installation by a water user connected to the City’s/District’s potable water system.

2. The City/District will provide, upon request, to any affected customer with a list of approved backflow prevention assemblies.

B. Backflow Prevention Assembly Installation

1. Backflow prevention assemblies shall be installed in a manner prescribed in Section 7603, Title 22 of the California Administrative Code. Location of the assemblies should be as close as practical to the user’s connection. The City/District shall have the final authority in determining the required location of a backflow prevention assembly.

a. Air-gap separation (AG) - The air-gap separation shall be located on the user’s side of and as close to the service connection as is practical. All piping from the service connection to the receiving tank shall be above grade and be entirely visible. No water use shall be provided from any point between the service connection and the air-gap separation. The water inlet piping shall terminate a distance of at least two (2) pipe diameters of the supply inlet, but in no case less than one (1) inch above the overflow rim of the receiving tank.

b. Reduced pressure principle backflow prevention assembly (RP) - The approved reduced pressure principle backflow prevention assembly shall be installed on the
user's side of and as close to the service connection as is practical. The assembly shall be installed a minimum of twelve inches (12") above grade and not more than thirty-six inches (36") above grade measured from the bottom of the assembly and with a minimum of twelve inches (12") side clearance. The assembly shall be installed so that it is readily accessible for maintenance and testing. Water supplied from any point between the service connection and the RP assembly shall be protected in a manner approved by the City/District.

c. Double check valve assembly (DC) - The approved double check valve assembly shall be located as close as practical to the user's connection and shall be installed above grade, if possible, and in a manner where it is readily accessible for testing and maintenance. If a double check valve assembly is put below grade it must be installed in a vault such that there is a minimum of six inches (6") between the bottom of the vault and the bottom of the assembly, so that the top of the assembly is no more than a maximum of eight inches (8") below grade, so there is a minimum of twenty four inches (24") of clearance between the side of the assembly with the test cocks and the side of the vault, and so there is a minimum of twelve inches (12") clearance between the other side of the assembly and the side of the vault. Special consideration must be given to double check valve assemblies of the "Y" type. These assemblies must be installed on their "side" with the test cocks in a vertical position so that either check valve may be removed for service without removing the assembly. Vaults which do not have an integrated bottom must be placed on a three inch (3") layer of gravel.

C. Backflow Prevention Assembly Testing and Maintenance

1. The owners of any premises on which, or on account of which, backflow prevention assemblies are installed, shall have the assemblies tested by a person who has demonstrated their competency in testing of these assemblies to the City/District. Backflow prevention assemblies must be tested at least annually and immediately after installation, relocation or repair. The City/District may require a more frequent testing schedule if it is determined to be necessary. No assembly shall be placed back in service unless it is functioning as required. A report in a form acceptable to the City/District shall be
filed with the City/District each time a assembly is tested, relocated, or repaired. These assemblies shall be serviced, overhauled, or replaced whenever they are found to be defective and all costs of testing, repair, and maintenance shall be borne by the water user.

2. The City/District will supply affected water users with a list of persons acceptable to the City/District to test backflow prevention assemblies. The City/District will notify affected customers by mail when annual testing of a assembly is needed and also supply users with the necessary forms which must be filled out each time a assembly is tested or repaired.

3. (OPTIONAL) Upon request the City/District will test a water user’s backflow prevention assembly to fulfill the requirements of this ordinance. The water user will be charged for the test and any maintenance found necessary to keep the assembly in working order on the next regular water bill.

D. Backflow Prevention Assembly Removal

1. Approval must be obtained from the City/District before a backflow prevention assembly is removed, relocated, or replaced.

   a. Removal: The use of a assembly may be discontinued and the assembly removed from service upon presentation of sufficient evidence to the City/District to verify that a hazard no longer exists or is not likely to be created in the future;

   b. Relocation: A assembly may be relocated following confirmation by the City/District that the relocation will continue to provide the required protection and satisfy installation requirements. A retest will be required following the relocation of the assembly;

   c. Repair: A assembly may be removed for repair, provided the water use is either discontinued until repair is completed and the assembly is returned to service, or the service connection is equipped with other backflow protection approved by the City/District. A retest will be required following the repair of the assembly; and

   d. Replacement: A assembly may be removed and replace provided the water use is discontinued until the replacement assembly is installed. All replacement assemblies must be approved by the City/District and must be commensurate with the degree of hazard involved.
SECTION V - USER SUPERVISOR

At each premises where it is necessary, in the opinion of the City/District, a user supervisor shall be designated by and at the expense of the water user. This user supervisor shall be responsible for the monitoring of the backflow prevention assemblies and for avoidance of cross connections. In the event of contamination or pollution of the drinking water system due to a cross-connection on the premises, the City/District shall be promptly notified by the user supervisor so that appropriate measures may be taken to overcome the contamination. The water user shall inform the City/District of the user supervisor's identity on, as a minimum, an annual basis and whenever a change occurs.

SECTION VI - ADMINISTRATIVE PROCEDURES

A. Water System Survey

1. The City/District shall review all requests for new services to determine if backflow protection is needed. Plans and specifications must be submitted to the City/District upon request for review of possible cross-connection hazards as a condition of service for new service connections. If it is determined that a backflow prevention assembly is necessary to protect the public water system, the required assembly must be installed before service will be granted.

2. The City/District may require an on-premise inspection to evaluate cross-connection hazards. The City/District will transmit a written notice requesting an inspection appointment to each affected water user. Any water user who cannot or will not allow an on-premise inspection of his piping system shall be required to install the backflow prevention assembly the City/District considers necessary.

3. The City/District may, at its discretion, require a reinspection for cross-connection hazards of any premise to which it serves water. The City/District will transmit a written notice requesting an inspection appointment to each affected water user. Any water user who cannot or will not allow an on-premise inspection of his piping system shall be required to install the backflow prevention assembly the City/District considers necessary.

B. Customer Notification - Assembly Installation

1. The City/District will notify the water user of the survey findings, listing the corrective actions to be
taken if any are required. A period of 60 days will be given to complete all corrective actions required, including installation of backflow prevention assemblies.

2. A second notice will be sent to each water user who does not take the required corrective actions prescribed in the first notice within the 60 days period allowed. The second notice will give the water user a two week period to take the required corrective action. If no action is taken within the 2 week period the City/District may terminate water service to the affected water user until the required corrective actions are taken.

D. Customer Notification - Testing and Maintenance

1. The City/District will notify each affected water user when it is time for the backflow prevention assembly installed on their service connection to be tested. This written notice shall give the water user 30 day to have the assembly tested and supply the water user with the necessary form to be completed and resubmitted to the City/District.

2. A second notice shall be sent to each water user which does not have his/her backflow prevention assembly tested as prescribed in the first notice within the 30 day period allowed. The second notice will give the water user a two week period to have his/her backflow prevention assembly tested. If no action is taken within the 2 week period the City/District may terminate water service to the affected water user until the subject assembly is tested.

SECTION VII - WATER SERVICE TERMINATION

A. General

When the City/District encounters water uses that represent a clear and immediate hazard to the potable water supply that cannot be immediately abated, the City/District shall institute the procedure for discontinuing the City/District water service.

B. Basis For Termination

Conditions or water uses that create a basis for water service termination shall include, but are not limited to, the following items:
1. Refusal to install a required backflow prevention assembly,
2. Refusal to test a backflow prevention assembly,
3. Refusal to repair a faulty backflow prevention assembly,
4. Refusal to replace a faulty backflow prevention assembly,
5. Direct or indirect connection between the public water system and a sewer line,
6. Unprotected direct or indirect connection between the public water system and a system or equipment containing contaminants,
7. Unprotected direct or indirect connection between the public water system and an auxiliary water system,
8. A situation which presents an immediate health hazard to the public water system.

C. Water Service Termination Procedures

1. For conditions 1, 2, 3, or 4, the City/District will terminate service to a customer's premise after 2 written notices have been sent specifying the corrective action needed and the time period in which it must be done. If no action is taken within the allowed time period water service may be terminated.

2. For conditions 5, 6, 7, or 8, the City/District will take the following steps:
   a. Make reasonable effort to advise water user of intent to terminate water service;
   b. Terminate water supply and lock service valve. The water service will remain inactive until correction of violations has been approved by the City/District.

(OPTIONAL) SECTION VIII - REQUIREMENTS FOR THE CERTIFICATION AS A BACKFLOW PREVENTION DEVICE TESTER

Each applicant for certification as a tester of backflow prevention assemblies shall file an approved application with the City/District Clerk, together with a fee as may be established by the City Council/District Board of Directors.
Competency in all phases of backflow prevention assembly testing and repair must be demonstrated by means of education and/or experience in order to obtain certification.

The following are minimum requirements:

a. Applicants shall have had at least two (2) years experience in plumbing or pipe fitting or equivalent qualifications.

b. Applicants shall hold a valid certification from the American Water Works Association (A.W.W.A.) California-Nevada Section, from a County certification program, or have equivalent training in the opinion of the City/District and the Health Department.

c. Each applicant for certification as a tester of backflow prevention assemblies shall furnish evidence to show that he has available the necessary tools and equipment to properly test such assemblies. He shall be responsible for the competency and accuracy of all tests and reports prepared by him.

The certificate issued to any tester is valid for a period of one year and may be revoked, suspended, or not renewed by the City/District for improper testing, repairs, and/or reporting.

SECTION IX - SEVERABILITY

If any section, subsection, subdivision, paragraph, sentence, clause, or phrase of this Ordinance, or any part thereof, is for any reason held to be invalid, such decision shall not affect the validity of the remaining portions of this Ordinance or any part thereof. The Council/Board hereby declares that it would have passed each section, subsection, subdivision, paragraph, sentence, clause, or phrase thereof, irrespective of the fact that any one or more sections, subsections, subdivisions, paragraphs, sentences, clauses, or phrases be declared invalid.

SECTION X - EFFECTIVE DATE

This Ordinance shall take effect thirty (30) days from the date of its passage. Before the expiration of fifteen (15) days after its passage, this Ordinance shall be published in the , a newspaper of general circulation, printed and published in the City/District of .
MODEL ORDINANCE NO. 2 - ABBREVIATED VERSION

AN ORDINANCE OF THE
INSTITUTING A CROSS-CONNECTION CONTROL PROGRAM
TO PROTECT THE PUBLIC WATER SYSTEM

THE (Water Supplier) DOES ORDAIN AS FOLLOWS:

SECTION I - PURPOSE

The purpose of this ordinance is to protect the public water supply system from contamination due to potential and actual cross-connections. This shall be accomplished by the establishment of a cross-connection control program as required by State regulations. This ordinance is adopted pursuant to Title 17, Section 7583 - 7605, inclusive, of the California Code of Regulations, entitled "Regulations Relating to Cross-Connections".

SECTION II - RESPONSIBILITY

The (General Manager/cross-connection control specialist) shall be responsible for implementing and enforcing the cross-connection control program. An appropriate backflow prevention assembly shall be installed by and at the expense of the water user at each user connection where required to prevent backflow from the water user's premises to the domestic water system. It shall be the water user's responsibility to comply with the (Water Supplier)'s requirements.

SECTION III - CROSS-CONNECTION PROTECTION REQUIREMENTS

The type of protection that shall be provided to prevent backflow into the public water supply system shall be commensurate with the degree of hazard, actual or potential, that exists on the water user's premises. Unprotected cross-connections with the public water supply are prohibited. The type of backflow prevention assembly that may be required (listed in decreasing level of protection) includes: Air-gap separation (AG), Reduced Pressure Principle Backflow Prevention Assembly (RP), and a Double Check Valve Assembly (DC). The water user may choose a higher level of protection than required by the water supplier. The minimum type of backflow protection required to protect the approved water supply at the user's water connection to premises with varying degrees of hazard are listed in Table 1 of Section 7604, Title 17. Situations which are not covered in Table 1 shall be evaluated on a case-by-case basis and the appropriate backflow protection shall be determined by the water supplier or health agency.
SECTION IV - BACKFLOW PREVENTION ASSEMBLIES

Only backflow prevention assemblies which have been approved by the (Water Supplier) shall be acceptable for installation by a water user. A list of approved backflow prevention assemblies will be provided upon request to any affected customer. Backflow prevention assemblies shall be installed in a manner prescribed in Section 7603, Title 17. Location of the assemblies shall be as close as practical to the user's connection. The (Water Supplier) shall have the final authority in determining the required location of a backflow prevention assembly.

Testing of backflow assemblies shall be conducted only by qualified testers and testing will be the responsibility of the water user. Backflow prevention assemblies must be tested at least annually and immediately after installation, relocation or repair. More frequent testing may be required if deemed necessary by the (Water Supplier). No assembly shall be placed back in service unless it is functioning as required. These assemblies shall be serviced, overhauled, or replaced whenever they are found to be defective and all costs of testing, repair, and maintenance shall be borne by the water user. Approval must be obtained from the (Water Supplier) prior to removing, relocating or replacing a backflow prevention assembly.

SECTION V - ADMINISTRATION

The cross-connection control program shall be administered by the (General Manager/cross-connection control specialist). The (Water Supplier) will establish and maintain a list of approved backflow prevention assemblies as well as a list of approved backflow prevention assembly testers. The (Water Supplier) shall conduct necessary surveys of water user premises to evaluate the degree of potential health hazards. The (Water Supplier) shall notify user when an assembly needs to be tested. The notice shall contain the date when the test must be completed.

SECTION VI - WATER SERVICE TERMINATION

When the (Water Supplier) encounters water uses that represent a clear and immediate hazard to the potable water supply that cannot be immediately abated, the procedure for terminating water service shall be instituted. Conditions or water uses that create a basis for water service termination shall include, but are not limited to, the following:
Model Ordinance No. 2 - Abbreviated Version
Page 3

1. Refusal to install or to test a backflow prevention assembly, or to repair or replace a faulty backflow prevention assembly.

2. Direct or indirect connection between the public water system and a sewer line.

3. Unprotected direct or indirect connection between the public water system and a system or equipment containing contaminants.

4. Unprotected direct or indirect connection between the public water system and an auxiliary water system.

For condition 1, the (Water Supplier) will terminate service to a water user's premises after proper notification has been sent. If no action is taken within the allowed time period water service shall be terminated.

For conditions 2, 3, or 4, the (Water Supplier) shall take the following steps:

1. Make reasonable effort to advise the water user of intent to terminate water service;

2. Terminate water service and lock service valve. The water service shall remain inactive until correction of violations has been approved by the (Water Supplier).

SECTION VII - EFFECTIVE DATE

This Ordinance shall supersede all previous cross-connection control ordinances and shall take effect thirty (30) days from the date of its adoption. Before the expiration of fifteen (15) days after its adoption this Ordinance shall be publish in the , a newspaper of general circulation, printed and published in

B-16
REVISED P.U.C. RULE 16 (C)

(insert when approved)
APPENDIX C: GUIDELINES FOR PROVIDING BACKFLOW PROTECTION
Public Water Supply Branch
Cross Connection Control Committee
Policy Statement Regarding
Replacement of Unapproved Backflow Preventers
June 15, 1988

STATEMENT OF PROBLEM

The revised cross-connection regulations have very specific requirements for backflow preventers which must be installed to protect against a cross-connection hazard. All backflow preventers must be constructed to meet the AWWA Standard C506-78(R83) and have passed laboratory and field evaluation tests performed by a recognized testing organization.

The Department's cross-connection regulations were originally instituted in 1953. Some utilities made good faith efforts to institute a cross-connection program. Some double check valve assemblies installed as a result of these early programs were "homemade" devices assembled from 2 swing checks, 2 gate valves, and several hose bibs. These devices do not meet the requirements of the revised regulations, but were installed under the old regulations and with the approval of the Department. Some utilities have hundreds of these assemblies installed and want guidance from the Department on when these homemade double check valves must be replaced, and under what circumstances and conditions they may be allowed to remain.
REFERENCES

1. Title 17, Section 7601, Approval of Backflow Preventers.

   Backflow preventers required by this Chapter shall have passed laboratory and field evaluation tests performed by a recognized testing organization which has demonstrated their competency to perform such tests to the Department.

2. Title 17, Section 7602, Construction of Backflow Preventers.

   (a) Air-gap Separation. An Air-gap separation (AG) shall be at least double the diameter of the supply pipe, measured vertically from the flood rim of the receiving vessel to the supply pipe; however, in no case shall this separation be less than one inch.

   (b) Double Check Valve Assembly. A required double check valve assembly (DC) shall, as a minimum, conform to the AWWA Standard C506-78(R83) adopted on January 28, 1978 for Double Check Valve Type Backflow Prevention Devices which is herein incorporated by reference.
(c) Reduced Pressure Principle Backflow Prevention Device. A required reduced pressure principle backflow prevention device (RP) shall, as a minimum, conform to the AWWA Standard C506-78 (R83) adopted on January 28, 1978 for Reduced Pressure Principle Type Backflow Prevention Devices which is herein incorporated by reference.

DISCUSSION

It seems reasonable to allow these homemade assemblies to remain if they can provide adequate protection since when they were installed they were acceptable assemblies. However, to ensure adequate protection the testing requirements for these assemblies must be the same as an approved double check valve assembly. This means they must be able to be tested using the accepted testing method for an approved assembly. If a homemade assembly cannot be tested using the accepted procedure it must be replaced with an approved assembly.

If a previously installed homemade double check valve assembly can be tested using the accepted procedure and it passes the test it may be allowed to remain in the system. However, if the homemade assembly does not pass the test and cannot be made to
pass the test, it should be removed and replaced with an approved assembly. A nonapproved device should also be replaced whenever reconstruction of the device (including replacement of any parts) is necessary for any reason.

Finally, utilities that have these homemade double check valve assemblies installed in their systems must be given a reasonable amount of time to gain compliance. An opportunity to test the assemblies must be given to each affected customer. The Department should allow a utility to go through its annual assembly testing cycle, then follow up on homemade assemblies which have failed. Each utility should be required to submit a proposed procedure for dealing with homemade double check valve assemblies.

POLICY STATEMENT

A utility which has homemade double check valve assemblies in its system may allow these unapproved assemblies to remain if they meet both of the following requirements:
1. The assembly must be able to be tested using the accepted procedure for an approved double check valve assembly.

2. The assembly must pass the testing process without the replacement of any of its component parts.

If a homemade assembly cannot meet both of these requirements it must be replaced with a backflow preventer which meets the requirements of Sections 7601 and 7602, Title 22 of the California Code of Regulations. A utility must require the affected customer to replace homemade assemblies which fail to meet the requirements given above. The time frame allowed shall be similar to that for the installation of a new assembly.
Memorandum

PWSB Management Staff

From: Peter A. Rogers  Chief
Public Water Supply Branch
714 P Street, Room 692
P. O. Box 942732
Sacramento, CA 94234-7320
8/473-1382

Date: February 1, 1988

Subject: Policy Memo 88-1 Cross-Connection

In order to respond to the question of adequate record keeping by water utilities which implement a cross-connection control program by means of a contract, the Cross-Connection Committee has developed a proposed policy statement. This policy, as expressed below, was approved by the Executive Committee and is effective immediately.

"If a water purveyor chooses to implement a cross-connection control program by means of a contract with another agency such as a local health agency, the utility should, as a minimum, keep on file an annual summary report prepared by the contract agency. This report should detail the locations and types of devices used within the service area to protect the public water system and any information regarding repairs. The contract agency would manage and run the cross-connection control program on a day-to-day basis, but would submit the annual report to each water utility. (Note: In PWSB districts, where efforts are being made to organize such cross-connection control programs, the submittal of an annual report to each member utility should be considered a requirement of an acceptable program.)
APPENDIX D: SAMPLE FORMS FOR CROSS CONNECTION
CONTROL PROGRAM RECORDS

Reprinted by permission of Santa Barbara County Department of
Environmental Health Services
# Device Inventory Form

**FORM: ** DEVICE INVENTORY

---

**CROSS CONNECTION DEVICE INVENTORY**

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<tr>
<th>DISTRICT #</th>
<th>CC #</th>
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<th>YR INSTALLED</th>
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<td><strong>TYPE:</strong></td>
<td><strong>MODEL:</strong></td>
<td><strong>SIZE:</strong> &quot;SERIAL #:**</td>
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**SITE NAME**

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**SERVICE ADDRESS**

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**COMMENTS**

**PHONE**

| DATE INSTALLED | METER # | CUST # |

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**MAILED NOTICE**

FIRST | SECOND | FINAL | NON COMP | FIRST REPAIR | SECOND REPAIR |

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**TEST DATA**

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ABC Company
123 North Main Street
Santa Maria, CA  93454

Meter protection - N side of driveway

FEBCO    RP    825Y    2"    12345

Mail to:  ABC Company
          Attn:  Maintenance Department
          Post Office Box 123
          Santa Maria, CA  93456

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<td>01-25-88</td>
<td>One Year - Jan '89</td>
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D-2
SITE NAME
Site Address - Street
Site Address - City

Device location

Device information - Mfg Type Model # Size Serial #

Mail to: Owner/Responsible Party Name
Attn:
Street or Mailing Address
CROSS CONNECTION SURVEY FORM

NAME ____________________________

SERVICE ADDRESS _______________________

MAILING ADDRESS _______________________

PH. ___________________ BUSINESS _________ WATER DIST. _______

ITEMS

1. OBJ SUBSTANCE — PRESS ( ) CC ( ) BFP ( ) II ( )
2. TOXIC SUBSTANCE — PRESS ( ) CC ( ) BFP ( ) II ( )
3. STEAM BOILER — TREAT ( ) CC ( ) BFP ( ) II ( )
4. PROCESS WATER — PRESS ( ) TOXIC ( ) CC ( ) BFP ( ) II ( )
5. WATER COOLED EQUIP — CC ( ) BFP ( ) II ( ) DIS*AG ( )
6. WATER TREAT — SOFT ( ) OTHER ( ) BFP ( ) II ( ) DIS*AG ( )
7. IRRIG — DOM ( ) AUX ( ) CC ( ) BFP ( ) II ( ) INJ ( )
8. TOILET — FLUSH ( ) TANK ( ) BFP ( ) II ( )
9. URINAL — FLUSH ( ) TANK ( ) BFP ( ) II ( )
10. DARKROOM — CC ( ) HB ( ) II ( )
11. LAB — ASPIRATOR ( ) CC ( ) HB ( ) BFP ( ) II ( )

12. BELOW RIM INLET ( ) TANK, VAT, SINK, TUB
13. HOSE BID ( ) CC ( ) BFP ( ) II ( )
14. POOL*FILL ( ) CC ( ) BFP ( ) II ( )
15. SEWAGE PRESS ( ) CC ( ) BFP ( ) II ( )
16. HIGH HAZARD CC ( ) BFP ( ) II ( )
17. OTHER WATER SUPPLY ( ) APPR ( ) FIRE ( )
18. METER BFP AG ( ) RP ( ) DC ( ) PVB ( )
19. AUTO FIRE SYSTEM ( )
20. IMPROPER PIPING ( )

REMARKS:
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_____________________________________________________________________________________
_____________________________________________________________________________________

Cross Connection Inspector ____________________________ Date ______________

Owner-Occupant Representative ____________________________ Date ______________

For further information, please call the Cross-Connection Inspection Office
Santa Barbara Office (964-8848)
Santa Maria Office (937-2061)

DIST: WHITE-5BC-HCS
YELLOW-OCUPPANT
PINK-WATER DISTRICT

HCS-200 (Rev. 3/87)
APPENDIX E: BACKFLOW PREVENTION ASSEMBLY
FIELD TEST PROCEDURES

Reprinted by permission of USC Foundation for Cross Connection Control and Hydraulic Research
BACKFLOW PREVENTION ASSEMBLY FIELD TEST PROCEDURES

9.1 Introduction

As part of a complete cross-connection control program, proper field test procedures for the required initial and subsequent annual tests must be used. In this Section the field test procedures are detailed for the following:

Section 9.2 – Reduced Pressure Principle Assembly

Section 9.3 – Double Check Valve Assembly

Section 9.4 – Pressure Vacuum Breaker Assembly

Properly calibrated gage equipment is essential to insure accurate data acquisition. In addition, methods to inspect the accuracy of the gages used in the above test procedures are supplied. Gaging equipment should be checked for accuracy at least once a year, and calibrated when necessary.

Section 9.5.1 – Differential gage calibration check – (water column)

Section 9.5.2 – Differential gage calibration check – (mercury manometer)

Section 9.5.3 – Duplex pressure gage calibration check – Dead weight tester

Note: Information regarding currently acceptable gaging equipment is available by contacting the office of the Foundation for Cross-Connection Control and Hydraulic Research.

The tester must observe the condition of the test gage equipment during all steps of the following field test procedures. Visually inspect the test gage equipment for obvious leakage or damage. Gage(s) should zero out when not pressurized; needle valves and fittings must be drip tight; gages should be drained after testing to protect against freezing.

As a prelude to each of the field test procedures it is essential to follow some basic steps.

1. Notify – Owner of assembly must be notified that water service will be shut off during test procedure. Special arrangements may have to be made so that interruption of service will not create a hardship on the user. If a fire sprinkler service is being shut down, the appropriate people should be notified.

2. Identify – Make sure that proper assembly is being tested by checking identification tag for make (manufacturer), model, and serial number. Record all of this information, as well as the test data, before leaving the location.

3. Inspect – Inspect the assembly for the required components for the field test procedure – i.e., upstream and downstream shut-off valves, properly placed testcocks.
4. Observe – Carefully observe area around the assembly for telltale signs of leakage – i.e., moss or algae growth, plant life, or soil erosion. This should supply the tester with additional information regarding the condition of the assembly before the test is performed. Example: Wet spot under relief valve port of reduced pressure principle assembly is an indication of relief valve activity, possibly from pressure fluctuations or fouling of the assembly. Proper testing will define the problem.

To give the tester more detailed information about the field test procedures, a number of improvements have been incorporated in the 8th Edition. Please note the following:

**RP (Section 9.2)**

The procedure for cleaning the testcocks before attaching the hoses of the gage has been added. It is important to minimize the possibility of dumping the relief valve before performing the relief valve opening point test (i.e. Test No. 1).

**RP (Section 9.2) and PVB (Section 9.4)**

One quarter (1/4) turn of the needle valve(s) on the differential gage will dictate when it is necessary to compensate for shutoff valve leaks. Opening the needle valve(s) more than approximately one-quarter (1/4) turn may create an error in the gage reading.

**PVB (Section 9.4)**

Gage and all unused hoses must be held at the same elevation as the PVB being tested. Even if the gage head is at the correct elevation, a low side hose which is filled with water and laying on the ground will cause an error in the gage reading. It is suggested that the unused hoses be coiled around the gage head to insure accurate readings.

**MAINTENANCE AND REPAIRS**

Consult the manufacturer’s repair/maintenance manuals before attempting any disassembly, large spring loads may be present in some designs.

To maintain the backflow prevention assembly in proper operating condition, the tester/repair person must follow some basic steps.

a) Use properly operating and calibrated gage equipment (see Section 9.5)

b) Use proper field test procedures (see Sections 9.2, 9.3, 9.4)

c) Consult manufacturer’s repair/maintenance manuals when disassembly is required.

d) Use only original manufacturer spare parts.

e) Immediately following repair, maintenance, or replacement procedures, the backflow prevention assembly must be retested.
9.2 REDUCED PRESSURE PRINCIPLE ASSEMBLIES

Equipment required:

a) Differential Pressure Gage – 0-15 PSID (0.1 or 0.2 psid graduations)

b) 3 - 6 ft. lengths- minimum 1/4” I.D. high pressure hose with screw type couplings

c) 1/4” Needle valves, for fine control of flows

d) 3 - 1/4” IPS × inverted flare (oxygen fitting, B-size, from welding) -brass or 1/4” IPS × 45° SAE flare connector – brass

e) Adapter fittings for each testcock size – brass 1/8”×1/4”, 1/4”×1/2”, 1/4”×3/4”

Fig. 9.1

Hookup of Equipment for Field Testing of Reduced Pressure Principle Assemblies
Field Test Procedure

Test No. 1

Purpose: To test the operation of the pressure differential relief valve.

Requirement: The pressure differential relief valve must operate to maintain the “zone” between the two check valves at least 2 psi less than the supply pressure.

NOTE: It is important that during this test the tester does not cause the relief valve to discharge before step “i” below.

Steps:

a. Open #4 test cock to establish flow through the unit, then flush water through test cocks #1, #2, & #3, by opening and closing each test cock one at a time, to eliminate foreign material. Be careful not to dump the relief valve during this process (open #2 test cock slowly). Close testcock #4.

b. Install appropriate fittings.

c. Install hose from the high side of the differential pressure gage to the #2 test cock.

d. Install hose from the low side of the differential pressure gage to the #3 test cock.

e. Open test cock #3 slowly and bleed all air from the hose and gage through the low side bleed needle valve. Maintain the low side bleed needle valve in the open position while the test cock #2 is opened slowly. Open the high side bleed needle valve to bleed the hose and gage. Close the high side bleed needle valve, then close the low side bleed needle valve after the gage has pinned at the upper end of the scale.

f. Close #2 shut-off valve.

g. Observe the apparent pressure drop across the #1 check valve; during all subsequent steps of this procedure the differential gage is “on line” showing the pressure drop across the #1 check valve.

h. Open the high side control needle valve, and then open the low side control needle valve no more than one-quarter (1/4) turn to by-pass water from the #2 test cock to the #3 test cock. If the low side control needle valve must be opened more than one-quarter (1/4) turn, then see Instructions for leaking No. 2 Shut-off Valve.

i. Watch the pressure differential drop slowly to the relief valve opening point – record this opening point value.

j. Close the needle valves.
Test No. 2

Purpose: To test the #2 check valve for tightness against reverse flow.

Requirement: The No. 2 check valve shall be tight against reverse flow under all pressure differentials.

Steps:

a. Maintain the No. 2 shut-off valve in a closed position (from test No. 1).

b. Vent all of the air through the by-pass hose by opening both the high side control needle valve and the bypass needle valve. Close the bypass needle valve only.

c. Install the by-pass hose from the gage manifold to the #4 test cock, then open the #4 test cock.

d. Bleed water from the “zone” by opening the low side bleed needle valve on the gage in order to re-establish the normal reduced pressure within the “zone”. Once the gage reaches the high end of the scale, close the low side bleed needle valve.

e. Open the bypass needle valve. If the indicated pressure differential remains steady then the No. 2 check valve is reported as “closed tight”. If the pressure differential falls to the relief valve opening point then the No. 2 check valve is noted as “leaking”, and Test No. 3 below can not be completed. If the pressure differential drops, but stops above the relief valve opening point, the No. 2 check valve can still be reported as “closed tight”. See the Troubleshooting for further explanation - Disc Compression.

Test No. 3

Purpose: To determine the tightness of check valve No. 1, and to record the static pressure drop across the check valve No. 1.

Requirement: The static pressure drop across check valve No. 1 should be at least 3.0 psi greater than the relief valve opening point (Test No. 1). This 3.0 psi “buffer” will prevent the relief valve from discharging during small fluctuations in upstream line pressure. A “buffer” of less than 3.0 psi does not imply a leaking check valve No. 1 (i.e. allowing backflow), but rather is an indication of how well the check valve No. 1 is holding.

Steps:

a. With the by-pass hose connected to test cock #4 as in step ‘c’ of Test No. 2 (above), bleed water from the “zone” through the low side bleed needle valve on the gage until the gage reaches the high end of the scale. Close the low side bleed needle valve. After the gage needle settles, the steady state pressure differential indicated (needle is not falling on the gage) is the actual static (i.e., no flow) pressure drop across check valve No. 1 and is to be recorded as such.

b. Close all test cocks, open shut-off valve No. 2, and remove all test equipment.
Values recorded from above Tests #1, #2, and #3

Test #1: Relief valve opening point – ___ psid
Test #2: Check valve No. 2 – tight/leak
Test #3: Check valve No. 1 – ___ psid

Instruction for a Leaking No. 2 Shut-off Valve (See Fig. 9-2)

If the pressure differential on the gage during the Test No. 1, step h, does not change (i.e. lower), or the low side control needle valve must be opened more than one quarter (1/4) turn, it is likely that the No. 2 shutoff valve is leaking. The No. 2 shutoff valve should be re-opened and closed in an effort to get a better seal. This may particularly occur when testing units which do not have resilient seated shutoff valves.

In tests No. 1, No. 2, and No. 3 above, a leaking No. 2 shut-off valve may affect the accuracy of the recorded values. A small leak in the No. 2 shut-off valve can be tolerated as long as the hose capacity is enough to satisfy the leak of the No. 2 shut-off valve. In test No. 1, step 'h', if the low side needle valve must be opened more than one-quarter (1/4) turn then the above procedure may provide invalid data. If the volume of the leak of the No. 2 shut-off requires more than one-quarter (1/4) turn of the needle valve, then fittings should be placed in the #1 and #4 test cocks to accomodate an additional temporary by-pass hose from the #1 test cock to the #4 test cock. A 1/2" or 3/4" hose may be needed to satisfy the leak in larger assemblies.

Attach temporary bypass hose to #1 testcock and bleed all air by opening #1 testcock, then close. Attach the other end of the temporary bypass hose to #4 testcock. Open #1 testcock to pressurize hose. Slowly open #4 testcock, observing the reading on the differential gage. Should the differential reading begin to drop, be prepared to record the value at which the relief valve opens. However, should the differential reading stabilize above the relief valve opening point return to Test No. 1, step 'h'. If the differential reading on the gage still won't drop to the relief valve opening point, then the leak through the No. 2 shutoff valve is too great to handle. Repair or replacement of the No. 2 shutoff valve is necessary before an accurate test can be completed.
Fig. 9.2

Compensation for No. 2 Shut-off Valve Leak
Disc Compression – Second Check Valve (see Fig. 9.3)

As high side pressure from the #2 testcock is being transferred to the #4 testcock (i.e. backside of the No. 2 check valve) during step ‘e’ of Test No. 2, the differential reading on the gage may drop. This lowering of the differential reading can be caused by the small backpressure created behind the 2nd check valve. This backpressure will cause the 2nd check valve seat to imbed more deeply into the elastomer disc. This decreases the trapped volume between the two check valves (i.e. the zone of reduced pressure) and, in turn, increases the pressure in the “zone”. An increase of the “zone” pressure will lower the differential pressure across the 1st check valve. To eliminate this false reading on the gage, the excess pressure built up in the “zone” must be bled off. This is done by opening the low side bleed needle valve (see step ‘a’, Test No. 3).

Fig. 9.3

Disc Compression – Second Check Valve
TROUBLE-SHOOTING

NOTE: Many problems can be corrected by cleaning the internal components. Carefully observe condition of components.

<table>
<thead>
<tr>
<th>Problem</th>
<th>May be caused by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relief Valve discharges continuously</td>
<td>1. Faulty 1st check</td>
</tr>
<tr>
<td></td>
<td>2. Faulty 2nd check with back-pressure condition</td>
</tr>
<tr>
<td></td>
<td>3. Faulty Relief Valve</td>
</tr>
<tr>
<td>Relief Valve discharges intermittently</td>
<td>1. Properly working assembly with backsiphonage condition</td>
</tr>
<tr>
<td></td>
<td>2. 1st check “buffer” is too small (i.e., less than 3.0 psi), with line pressure fluctuation</td>
</tr>
<tr>
<td></td>
<td>3. Water hammer</td>
</tr>
<tr>
<td>Relief Valve discharges after No. 2 Shut-off Valve is shut (Test #1)</td>
<td>1. Normally indicates faulty 1st check a)dirty or damaged disc b)dirty or damaged seat</td>
</tr>
<tr>
<td>Relief Valve would not open, differential on the gage would not drop (Test #1)</td>
<td>1. Leaky No. 2 Shut-off Valve with flow through the assembly</td>
</tr>
<tr>
<td>Relief Valve would not open, differential drops to zero (Test #1)</td>
<td>1. Relief Valve stuck shut due to corrosion or scale</td>
</tr>
<tr>
<td></td>
<td>2. Relief valve sensing line(s) plugged</td>
</tr>
<tr>
<td>Relief Valve opens too high (with sufficiently high 1st check reading)</td>
<td>1. Faulty Relief Valve a. Dirty or damaged disc b. Dirty or damaged seat</td>
</tr>
<tr>
<td>1st Check reading too low (less than 3.0 psi “buffer”) (Tests #1 &amp; #3)</td>
<td>1. Dirty or damaged disc</td>
</tr>
<tr>
<td></td>
<td>2. Dirty or damaged seat</td>
</tr>
<tr>
<td></td>
<td>3. Guide members hanging up</td>
</tr>
<tr>
<td>Leaky 2nd Check (Test #2)</td>
<td>1. Dirty or damaged disc</td>
</tr>
<tr>
<td></td>
<td>2. Dirty or damaged seat</td>
</tr>
<tr>
<td></td>
<td>3. Guide members hanging up</td>
</tr>
</tbody>
</table>

Repair note: Lubricants shall only be used to assist with the reassembly of components, and shall be non-toxic.
9.3 Double Check Valve Assemblies

A pair of calibrated bourdon tube gages or a calibrated duplex gage can also be used for field testing a double check valve assembly. The equipment needed is as follows:

a) Bourdon tube gages, Duplex gage, or transducer type gage with 1 or 2 psi increments and with an adequate range to handle the expected maximum water line pressure. Minimum 4-1/2" diameter, accuracy grade 1A or better, per ANSI/ASME B40.1 – 1985.

b) Needle valves and fittings as indicated in the sketch.

c) Three lengths, approximately 5 feet each, of high pressure 1/4 inch hose, with screw type couplings

d) Six 1/4" IPS x 1/4" inverted flare fittings (ie. welding supply – oxygen fitting) or 1/4" IPS x 45° SAE flare connectors

e) Adapter fittings for the range of assemblies - 4 each, brass 1/8 x 1/4, 1/4 x 1/2, 1/4 x 3/4
Field Test Procedure

Test No. 1 (See Fig. 9.4)

Purpose: To test No. 1 check valve for tightness against reverse flow.

Requirement: The check valve shall be tight against reverse flow under all pressure differentials.

Steps:

a. Bleed water through all four test cocks to eliminate foreign material.

b. Install appropriate fittings.

c. Connect the high side hose to test cock #2 and connect the the low side hose to test cock #3. Connections must be drip tight!

d. Open test cocks #2 and #3, then bleed hoses, making sure to bleed the low side last.

e. Close #2 shut-off valve; then close #1 shut-off valve.

f. By means of the high side needle valve lower the pressure at test cock #2 about 2 psi below the pressure at test cock #3. (Refer to trouble shooting comments regarding check valve disc compression.) If this small difference can be maintained then check valve #1 is reported as "tight" or "OK". Proceed to Test No. 2. However, if this small difference cannot be maintained proceed to the step 'g'.

g. Open shut-off valve #1 to repressurize the assembly.

h. Loosely attach the bypass hose to test cock #1, and bleed from the gage through the bypass hose by opening the low side needle valve to eliminate trapped air. Close low side needle valve. Tighten bypass hose. Open test cock #1.

i. Close #1 shut-off valve.

j. By loosening the low side hose at test cock #3, lower the pressure in the assembly about 10 psi below normal line conditions.

k. Simultaneously open both needle valves very slowly. If the check valve is holding tight, the high pressure gage will begin to drop while the low pressure gage will increase. Close needle valves. If the gage shows that a small (no more than 5 psi) backpressure is created and held, then the check valve is reported as "tight" or "OK". If the check valve leaks, a pressure differential is not maintained as both gages tend to equalize or move back towards each other, then the check valve is reported as "leaking". With both needle valves open enough to keep the needles on the gage stationary, the amount of leakage is visible as the discharge from the upstream needle valve. (see trouble-shooting for further comments)

l. Close all test cocks, remove all equipment and reopen #1 shut-off valve.

Test No. 2

Purpose: To test No. 2 check valve for tightness against reverse flow.

Requirement: The check valve shall be tight against reverse flow under all pressure differentials.
Steps:

Exactly the same as in Test No. 1 (above) except that the high side hose is connected to test cock #3 and the low side hose is connected to test cock #4. The bypass hose is again connected to test cock #1 for steps h thru k above.

a. Return assembly to normal operating condition.

TROUBLE-SHOOTING

NOTE: Many problems can be corrected by cleaning the internal components. Carefully observe condition of components.

<table>
<thead>
<tr>
<th>Problem</th>
<th>May be caused by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaky Check Valve (Test #1 or #2)</td>
<td>1. Dirty or damaged disc</td>
</tr>
<tr>
<td></td>
<td>2. Damaged seat</td>
</tr>
<tr>
<td></td>
<td>3. Guide members hanging up</td>
</tr>
<tr>
<td></td>
<td>4. Hinge pins</td>
</tr>
</tbody>
</table>

Repair note: Lubricants shall only be used to assist with the reassembly of components, and shall be non-toxic.

Leaking Shut-off Valves

During tests #1 and #2 above, possible shut-off valve leaks must be distinguished from a faulty check valve. Following the split of the gages during the confirmation test (step k), any movement of the gages must be closely observed. A failing check valve is only diagnosed when both gages move towards each other at the same rate (i.e., the pressure differential is equalizing). However, if only one of the gages moves without affecting the other, then something other than the check valve must be considered. During the confirmation test the following should be clearly understood.

(Note: All external leaks at fittings, packing glands, flanges, or gage needle valves should be eliminated before attributing the shut off valve as the source of the problem.)

If the high side gage begins to increase by itself with no movement of the low side gage, then the No. 1 shut-off valve is leaking.
If the low side gage begins to decrease by itself with no movement of the high side gage, then the No. 2 shutoff valve is leaking to a lower pressure downstream.

If the low side gage begins to increase by itself with no movement of the high side gage, then the No. 2 shutoff valve is leaking with a backpressure from a downstream source.

Check Valve Disc Compression

During the ‘initial test’ above (step f), both the high and low side gages may drop at the same rate, in which case the check valve would normally be assessed as leaking. However, after both gages have fallen approximately 10 – 15 psi, the high side gage finally drops and holds the required 2 psi below the low side gage. Even though both gages originally fell together, the check valve is holding tight. The reason for this is that the check valve disc is compressing as a backpressure is created. As the high (upstream) pressure is bled off to drop the 2 psi (step f), the downstream pressure begins to push harder on the backside of the check valve. So as the seat imbeds further into the elastomer disc, the volume on the backside of the check valve increases. With an increase in volume there is a corresponding decrease in pressure. So as the high side gage is lowered, the disc compression causes a lowering on the low side gage too. Once the disc stops compressing, then the high side gage will drop below the low side gage and the check valve will show as holding tight. Depending on the line size of the assembly being tested, or the particular “softness” of the check valve disc, different characteristics will be observed.
9.4 Pressure Vacuum Breakers

Note: This procedure is for the new design of loaded air inlet valve pressure vacuum breakers.

Equipment required:

a) Differential pressure gage – 0-15 psid (see note in section 9.1)
b) Length of 1/4" hose with screw type couplings
c) Adapter fitting - 1/4" IPS x 45° SAE flare connector - brass or 1/4" IPS x inverted flare (oxygen fitting, B-size, from welding)-brass 2-1/4" IPS female x 1/8" IPS male adapter - brass
d) Street ell

Fig. 9.5

Pressure Vacuum Breaker

NOTE: For both of the following tests the differential pressure gage must be held at the same level as the assembly being tested. Be sure that hoses not being used are also kept at this level.
TEST NO. 1

Purpose: To test the opening pressure differential of the air inlet valve.

Requirement: The air inlet valve shall open when the pressure in the body is no less than 1.0 psi above atmospheric pressure. And, the air opening valve shall be fully open when the water drains from the body.

Steps:

a. Bleed water through both test cocks to eliminate foreign material.
b. Install appropriate fittings.
c. Remove air inlet valve canopy.
d. Install the high side hose of the differential pressure gage to test cock #2, open test cock #2, and bleed air from the hose and gage.
e. Close #2 shut-off valve, then close #1 shut-off valve.
f. Slowly open the high side bleed needle valve, being especially careful not to drop the pressure differential too fast. Record the pressure differential at which the air inlet valve opens. If the high side bleed needle valve must be opened more than one-quarter (1/4) turn to get the pressure to fall in the body, see troubleshooting “Leaking No. 1 shut-off valve”.
g. Close test cock #2, and remove equipment.
h. Open #1 shut-off valve.

TEST NO. 2

Purpose: To test the check valve for tightness in the direction of flow.

Requirement: The check valve shall be drip-tight in the normal direction of flow when the inlet pressure is 1 psi and the outlet pressure is atmospheric.

Steps:

a. Attach high side hose of differential gage to test cock #1, open test cock #1, and bleed all air from the hose and gage by opening high side bleed needle valve. Close high side bleed needle valve.
b. Close #1 shut-off valve.
c. Open test cock #2. The air inlet valve will open and the water in the body will drain out through testcock #2. When this flow of water stops, the differential pressure indicated by the gage after it has settled will be the pressure drop across the check valve. This value must be 1.0 psid or greater. Record this value. If water continues to flow out of test cock #2, see troubleshooting “Leaking No. 1 shut-off valve”.
d. Close test cocks #1 and #2, and remove equipment.
e. Open #1 shut-off valve, then #2 shut-off valve.
f. Replace air inlet valve canopy.
Leaking No. 1 shutoff valve

Test No. 1 - Should the high side bleed needle valve need to be opened more than one-quarter (1/4) turn, it is likely that the No. 1 shutoff valve is leaking. The No. 1 shutoff valve should be re-opened and closed in an effort to get a better seal. This may particularly occur when testing units which do not have resilient seated shutoff valves. Should the leak persist then the leak must be diverted so that the air inlet valve can be tested. Open the #1 Testcock slowly to divert the leakage from the No. 1 shutoff valve, monitoring the gage while this is being done. Once the leakage has been diverted to the #1 Testcock, continue with step ‘f’. If the shutoff valve leak exceeds the limit of the testcock, then the test cannot be completed until the shutoff valve is repaired or replaced.

Test No. 2 - Should water continue to flow out of testcock #2 during test No. 2, this indicates that the #1 shut-off valve is leaking. An accurate numerical value cannot be read off of the differential gage, however the integrity of the check valve can be assessed. Install a 1/4” street ell in testcock #2 such that the open end faces upward. Fill the street ell with water by cracking open the No. 1 shutoff valve, then close the No. 1 shutoff valve again. Open testcock #1. The leaky No. 1 shutoff valve will continue to flow through testcock #1. If the water level in the street ell remains constant, then this small backpressure is not leaking back through the check valve and it can be recorded at “tight”. If the water level in the street ell drains out, then the check valve is not supporting the small backpressure and it is recorded as “leaking”.

Fig. 9.6

Leaking No. 1 Shutoff Valve
TROUBLE-SHOOTING

NOTE: Many problems can be corrected by cleaning the internal components. Carefully observe condition of components.

<table>
<thead>
<tr>
<th>Problem</th>
<th>May be caused by</th>
</tr>
</thead>
</table>
| Air inlet valve does not open, as gage drops to 0.0 psid. | 1. Air inlet disc stuck to seat  
2. Broken or missing air inlet spring  
3. “Old style” pressure vacuum breaker (non-loaded air inlet valve) |
| Air inlet valve does not open, and differential on gage will not drop | 1. Leaky No. 1 shutoff valve  
2. Parallel installation with leaky No. 2 shutoff valve. |
| Air inlet opens below 1.0 psid | 1. Dirty or damaged air inlet disc  
2. Scale buildup on seat |
| Check valve below 1.0 psid | 1. Dirty or damaged check disc  
2. Damaged seat |
| Water runs continuously from testcock #2 (Test No. 2) | 1. Leaky No. 1 shutoff valve |

Repair note: Lubricants shall only be used to assist with the reassembly of components, and shall be non-toxic.
9.5 Gage Calibration Check

9.5.1 Differential Gage Calibration Check – Water Column

Materials

1) Two transparent tubes (approx. 1-inch diameter) minimum length – 5 ft.
2) Adapters from transparent tube to gage – Rubber stoppers, nipples, ells.

Procedure

1) Attach high side hose to base of one transparent tube.
2) Attach low side hose to base of second transparent tube.
3) Fill transparent tubes with water.
4) Bleed air from gage by opening high side bleed valve, then close; then open low side bleed needle valve and close.
5) Fill or drain transparent tubes to desired height ‘h’.

27.2” Water = 1.0 psi
55.5” Water = 2.0 psi
83.4” Water = 3.0 psi
etc.

6) Compare gage reading to water column height ‘h’, the two values should be the same.
7) If gage requires adjustment, contact the gage manufacturer or a qualified gage repair shop.

Fig. 9.7
Differential Gage Calibration Check Water Column
9.5.2 Differential Gage Calibration Check – Mercury Manometer

Materials

1) Mercury manometer – minimum length 36".

2) Miscellaneous pipe fittings – see sketch below.

3) Pressure reducing valve – proper range so that available line pressure can be reduced up to 15 psi.

CONVERSION FACTOR – Water over mercury: 1" Hg = 0.455 psi

Procedure

1) Attach hoses from mercury manometer to crosses on either side of the pressure reducing valve.

2) Attach high side hose of the differential gage to the upstream (high side) cross, and the low side hose to the downstream (low side) cross.

3) Set pressure reducer to open position (no pressure reduction).

4) Turn on inlet pressure.

5) Bleed air out of the manometer hoses by carefully opening the bleed valves at the top of each leg of the manometer.

6) Bleed air out of differential gage by bleeding through the high side hose first, then the low side hose. Both the manometer and the differential gage should be reading 0.0 psid at this time.

7) Open the low side bleed needle slightly and adjust the pressure reducing valve to establish approximately a 1.0 psid differential. Close the bleed needle valve.

8) Compare the values between the manometer and the differential gage. (i.e., measure the deflection of the mercury ‘H’ and multiply by 0.455 to convert the value to pounds per square inch differential – psid.) Both the manometer and the differential gage should be reading the same value.

9) Repeat steps #7 and #8 with greater differential values – 2.0, 3.0, 4.0, etc., up to 15.0 psid.

10) If gage requires adjustment, contact the gage manufacturer or a qualified gage repair shop.
Differential Gage Calibration Check
Mercury Manometer

9.5.3 Duplex Pressure Gage Calibration Check – Dead Weight Tester

1) Dead weight tester – with various weights so that gage can be tested throughout entire range (i.e., 0-200 psi, 0-300 psi).

Procedure

1) Check that dead weight tester is filled with clean oil.

2) Attach gage being tested to dead weight tester.

3) Add sufficient weights so that the gage can be read from one of the scale to the other. Select at least five (5) separate test points over the entire range while increasing the pressure. Then use the same test points for decreasing pressure.

4) Record the readings. If the gage does not read accurately then the needle on the gage must be removed and set properly. Some gage needles have adjustment screws so that the needle does not have to be removed.

(Refer to Section 6 of the ANSI/ASME Standard B40.1-1985 for more information regarding pressure gage testing.)

NOTE: A field test of the duplex gage can be done by hooking up both high side and low side hoses to the same pressure through a tee. Both gages must read the same valve. Should the needle indicate different values while hooked up to the same pressure, contact the gage manufacturer or a qualified gage repair shop for proper maintenance and calibration.