

# USC

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Foundation for  
Cross-Connection  
Control and  
Hydraulic Research

## Questions and Answers about Field Testing

Backflow Prevention assembly testers often call the Foundation office with questions regarding some particular field test procedure. Many questions are also posed by those attending a Foundation Training course, or those preparing for a certification exam. Here are a couple of the most commonly asked questions about field testing the double check valve assembly under the Ninth Edition of the *Manual of Cross-Connection Control*.

***While testing the double check can I move the bleed valve arrangement from the test cock to the gage when field testing the double check?***

The bleed valve is used during the field test of the double check valve assembly to compensate for a limited leak in the No. 1 shutoff valve. (See Figure 1 on page four.) It may seem that the tester can still control the amount of water coming out of the bleed valve should it be attached to the gage instead of the test cock of the assembly. (See Figure 2 on page four.)

After all the water is still leaking through the No. 1 shutoff valve and being bypassed to atmosphere before reaching the check valve, thus allowing the check valve to seat. However, even though the tester may compensate for the leak

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## Troubleshooting

***There's more to a Test than hooking up a gage***

Many of those attending the Foundation's *Course for the Training of Backflow Prevention Assembly Testers* are surprised to find out how much there is to learn. This is because many are not aware of all that is involved in testing a backflow preventer until they actually perform the test themselves. Although the initial test of each of the backflow preventers may be considered fairly simple after some training; the complexities come in with the troubleshooting portions of the testing. There are several problems, which may occur with each of the assemblies being tested: the double check valve assembly, the reduced pressure principle assembly and the pressure vacuum breaker assembly. The testing procedures for each of the assemblies, including troubleshooting will be examined briefly in this article.

### **The Double Check Valve Assembly**

According to the Ninth Edition of the *Manual of Cross-Connection Control*, when testing the double check valve assembly, the tester wants to determine if each of the two check valves holds the minimum acceptable value of 1.0 psid in the direction of flow. Additionally, we can determine if either of the shutoff valves is leaking, with or without backpressure. The troubleshooting becomes even

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**I n s i d e C r o s s T a l k**

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## Foundation Membership

The Foundation's Membership Program provides many benefits to the Members of the Foundation. These include: twenty percent discounts on Foundation Training courses for any employee of the Member company/organization, the *List of Approved Backflow Prevention Assemblies*, printed quarterly, and access to the up-to-the-minute version of the List for those Members with Internet access.

Members are encouraged to call the Foundation with technical questions. The Foundation's Engineering Staff is available to assist Members with the various aspects of field testing backflow preventers, installing backflow preventers, and administering their cross-connection control program.

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# Troubleshooting

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more complex when two or more problems occur simultaneously. Possible scenarios while testing the double check include the following:

1. Everything working properly
2. Leaking No. 1 shutoff valve (but testable)
3. Leaking No. 1 shutoff valve (too severe to test)
4. Low reading on No. 1 check valve (0.1 – 0.9 psid)
5. Low reading on No. 2 check valve
6. Leaking No. 1 check valve (0.0 psid)
7. Leaking No. 2 check valve
8. Leaking No. 2 shutoff valve
9. Leaking No. 2 shutoff valve with backpressure.

## The Reduced Pressure Principle Assembly

In testing the reduced pressure principle assembly, there are three



items we are essentially looking at: The first check valve, the second check valve, and the differential pressure relief valve. We also have the possibility of a leaking No. 2 shutoff valve, with or without backpressure. The relief valve must open at a differential pressure of at least 2.0 psid. The first check should hold at a value of at least 3.0 psid above the relief valve opening point. Although this “buffer” value of 3.0 psid may vary from one administrative authority to another. The Foundation’s

recommendation is a 3.0 psid buffer as this is part of the design criteria. Some of the possible scenarios while testing the reduced pressure principle assembly include the following:

1. Everything working properly
2. Leaking No. 1 check valve
3. Low No. 1 check

**Because of the many complex scenarios which a backflow prevention assembly tester experience, the Foundation’s Tester Training Courses place a large emphasis on troubleshooting**

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## Field Testing, Q & A

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in this manner, the location of the bleed valve may cause an error in the gage reading.

The gage is most accurate when there is no water



The Illustration at the bottom of the next page shows how water flowing through the hose changes the pressure reading from one end of the hose to the other. The less straight the hoses are, the more friction loss there is. It takes more energy for water to flow through curved sections of hoses or pipes than to flow through straight sections. So, curves, or wrapping part of the hose around the gage, could also affect the pressure loss through a given length of hose. This doesn't mean that the hoses need to be straight during normal testing. The procedures are designed to minimize the errors due to friction loss. It is also important to keep in mind these graphics are only for illustration purposes and exaggerate the pressure differences.

flowing through the gage manifold or the hose. As illustrated at the top center of these pages, the pressure on either end of the hose is the same when there is no flow through it. As water flows through the hose, pressure is lost. This is due to friction between the water and the inside surface of the hose. The same phenomenon also occurs as water flows through any piping system.

Taking this concept and transferring it to the DC field test procedures, it is found that water flowing through the hose could cause a false reading at the gage. This is why the procedure calls for the bleed off valve arrangement to be attached to the upstream test cock as opposed to the gage itself.

***Can I use the bleed needle valve on my gage instead of the bleed valve arrangement?***

Bleeding the water through the high bleed valve on the gage instead of from the upstream test cock will create similar problems as attaching the bleed off valve to the gage, as discussed earlier in this article. In fact, the same problem would occur. Additionally, the flow of water through the gage past the high pressure sens-

ing region may cause false readings. Water flowing through the top of a tee could reduce the pressure on the leg of the tee, siphoning water up the leg of the tee. In fact this is a common means of creating backsiphonage. See the tee to the right.

This “aspirator effect” can cause false gage readings. This is the reason, in several cases, there is a limit of opening a needle valve only one-quarter turn. This limits the amount of water flowing past the gage and prevents false readings on the gage. When testing the reduced pressure principle assembly, for example, the tester should not open the low side control needle valve more than one-quarter turn when determining the relief valve opening point. If the needle valve is opened more than one-quarter turn, the gage may give false readings due to this aspirator effect.

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# Troubleshooting

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**The backflow preventers used in Foundation Training Courses are modified so that various scenarios may be created with the turn of a valve or two.**

- valve
4. Low relief valve opening point (0.1- 1.9 psid)
  5. Relief valve does not open.
  6. Leaking No. 2 check valve
  7. Leaking No. 2 check valve with backpressure.
  8. Leaking No. 2 shutoff valve
  9. Leaking No. 2 shutoff valve with backpressure
  10. Low buffer between relief valve opening and No. 1 check reading

## **The Pressure Vacuum Breaker Assembly**

The pressure vacuum breaker assembly contains a check valve and an air inlet valve. The tester must determine if the check valve holds at least 1.0 psid in the direction of flow and whether or not the air inlet valve opens above 1.0 psid. The tester should also be able to determine if either of the shutoff valves is leaking. When testing the pressure vacuum breaker assembly any of the following scenarios may exist:

1. Everything working properly
2. Leaking check valve (0.0 psid)
3. Low check

- valve reading (0.1-0.9psid)
4. Low air inlet valve reading (0.0 – 0.9 psid)
  5. Air inlet valve doesn't open
  6. Leaking No. 1 shutoff valve
  7. Leaking No. 2 shutoff valve

As the various combinations are encountered this list grows longer and longer. It can be seen easily that the complexities of the field test procedures are well beyond the “hook up a gage and see if it works” concept that many people have. The proper field testing of a backflow prevention assembly requires a thorough knowledge of the procedure and the many potential scenarios.

The skills of a backflow prevention assembly tester go well beyond following a set of steps by rote. The tester must have a solid understanding of how the assemblies work. With this knowledge the tester is able to determine what is occurring internally from the observances made on the gage at different junctures in the field test procedure. This is why the Foundation's Tester Training Courses place so much emphasis on troubleshooting the assemblies. The tester must have the opportunity to test assemblies with different scenarios in order to recognize the various problems, which occur while field testing.

The backflow preventers used in Foundation Training Courses are modified so that various scenarios may be created with the turn of a valve or two. This enables the students to practice the field test procedures with the various conditions being simulated.

# Manual Update

## New Concept of Detector Assembly Suggested

The *Manual of Cross-Connection Control* is currently under revision. With this revision the Manual Review Committee (MRC) has had several open meetings. During these meetings representatives of backflow prevention assembly manufacturers, gage manufacturers, water agencies, health agencies, and individuals are welcome to present any information to the committee which they feel will benefit the users of the Tenth Edition of the Manual. Several suggestions have already been made.

One innovative suggestion, which has been “approved in concept,” is the suggestion that specifications for a new type of detector assembly be included in the next edition of the manual. The specifications would be for both a double check detector assembly and a reduced pressure principle detector assembly.

Initially many think that this type of assembly will not provide the protection that the original concept of a DCDA and RPDA provide. However, upon close examination, the assembly

provides the same level of protection. Shown here is a computer-generated concept of the new type of DCDA. Note that all water flows through the number one check valve AND either the number two check valve or the bypass check valve. So all water must flow through two check valves.

Likewise, any backflow would need to overcome two check valves just as with the currently approved DCDA.

Any suggestions or comments regarding the Tenth Edition of the Manual may be sent to the Foundation office or comments may be left on the MRC web site. The latest information is also available on this web site.

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## Training Courses

### Tester Course

Los Angeles, CA  
13-17 July 1998

Incline Village, NV  
17-21 August 1998

Charleston, SC  
14-18 September 1998

Las Vegas, NV  
19-23 October

### Specialist Course

Los Angeles, CA  
20-24 July 1998

Las Vegas, NV  
2-6 November 1998

**Foundation for Cross-Connection  
Control and Hydraulic Research  
School of Engineering**

University of Southern California  
Kaprielian Hall 200  
Los Angeles, California 90089-2531

## Upcoming Events

JIC Workshop  
•Santa Ana, CA  
12 August 1998

N. California Backflow Prevention  
Association Annual Workshop  
•Pleasanton, CA  
27 August 1998

Inland Counties Backflow Group  
•San Bernardino, CA  
23 September 1998

Blue Grass Cross-Connection  
Prevention Association  
•Lexington, KY  
25 September 1998

Western Regional Backflow  
Conference  
•Las Vegas, NV  
28-30 September 1998

CA/NV AWWA Fall Conference  
28-30 Sept - Western Regional  
Backflow Conference  
•Reno, NV  
7 October 1998

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