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Foundation for
Cross-Connection
Control and
Hydraulic Research

Disassembling Assemblies

Once in a while a tester will have an incredibly difficult time removing internal components from a backflow preventer. Once the component is finally removed, the tester can discover no reason why the component wouldn't come out in the first place. The culprit in these cases is possibly a phenomenon called hydraulic lock.

Hydraulic lock works on the same principles as a suction cup. When a suction cup is applied to a surface, especially after being moistened, it sticks. The suction cup can hold steady, even when being pulled with great force. When a suction cup is put in place, most of the air between the suction cup and a smooth surface is evacuated. When the suction cup is lifted, the center of the cup lifts off the surface first. As it is pulled away, it creates a vacuum between the cup and the smooth surface. Since the edge of the cup is sealed against the smooth surface, no air can come in to break the vacuum. Only by great force, or lifting the edge of the cup, can the vacuum be broken and the suction cup lifted.

This exact same phenomenon can occur inside of a backflow preventer. The rubber disc material acts as the suction cup. Depending upon the geometry of the assembly the disc may get "stuck" in position, when pressure is dropped upstream of the check valve. This, in essence, is the

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Foundation Receives AWWARF Project

In the last issue of Cross Talk the AWWARF study, National Assessment of the Impact of Cross Connections in North American Water Supplies was partially discussed. This issue of Cross Talk will continue where the last issue left off summarizing the project.

A survey will be conducted covering several water agencies. The survey will quantify information in several areas. Seven of these were discussed in the last issue of Cross Talk. Here, the discussion begins with point eight.

8) Elements of a Cross-Connection Control Program

The most effective elements of a cross-connection control program will be identified. Included in this will be:

- What type of legal authority is effective in a cross-connection control program?
- What elements of the regulation, or ordinance are necessary, most effective and enforceable?
- What type backflow preventers are most effective?
- Are certain types of backflow preventers most effective under specific conditions?
- Is there a regular field-testing requirement for backflow preventers?
- What methods are effective for testing the backflow preventers?

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

The AWWARF Project • Hydraulic Lock
Manual Update • Training Schedule

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, administering their cross-connection control program.

AZMO Mechanical
Backflow Assembly Testing & Supply
Brunswick County Pub. Util.
Calipatria State Prison
Ch2m Hill
Chinese Plumbers
Citrus County Utilities
Concho Rural Water Corp.
Cross-Tech
Crucible Specialty Metals
Curtis Plumbing
Department of Water Supply
Fallon Naval Air Station
Garland, City of
Hamilton Western Utilities, Inc.
Hugh M. Cunningham, Inc.
J.O. Mory, Inc.
Joint Apprenticeship & Training Trust
Ken Russell Sprinkler Systems
Kingston Water Dist.
McNeil Consumer Products Co., PR
Merrick & Company
Mission, City of
Monji Enterprises
Montour Industrial Supply
Morrison Supply Company
Naval Facilities Engineering Command
Navy Public Works Center, Miramar
R. Tsukushi Backflow Tester
R4 Enterprises, Inc.
Rand Engineering
Ridgeland, City of
Ryan Fire Protection, Inc.
South Sioux City, City of
Sprinkler Fitters L.U. 268
Tahoe City Public Utility District
Topsfield Water Dept.
Vacaville, City of
Wastewater Reclamation Facility
Wickenburg, Town of
Willing's Repair Service

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Foundation Receives AWWARF Project

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- What requirements are needed for those field testing the backflow preventers?
- What requirements are needed for those surveying sites to determine what, if any, backflow prevention is needed on the premises?
- What types of cross-connection records are maintained and how detailed are they?
- How important/effective is education in the program?

Additionally, other elements of an effective program will be identified via the survey.

9) Relationship of Public Education to enforcement

It is believed, by many involved in cross-connection control, that public education is the most effective means of bringing customers into compliance. This survey will determine the accuracy of this statement, as well as ascertain which type of public education is most effective in facilitating an effective cross-connection control program.

10) Evaluation of Customer Complaints

The survey will attempt to determine the probability of specific customer complaints being related to cross-connection incidents. An analysis of the number and type of complaints will be correlated with common cross-connections to see if there is a correlation.

11) Administration of Cross-Connection Control Programs
Common problems encountered in administering a cross-connection control program will be analyzed to determine if there are specific recurring problems in different regions of North America. An

analysis of how administrative authorities work together to abate cross-connections will be conducted.

III. Analysis of the Survey Data and Workshop I

Survey data obtained from the respondents will be analyzed and correlated to see whether there are any recognized patterns: regional distribution, urban or rural distribution, large or small utilities, etc.

These preliminary findings will be presented in Workshop I to be conducted in April of 2000 in order to invite greater input from the water utilities as well as the cross-connection control professionals.

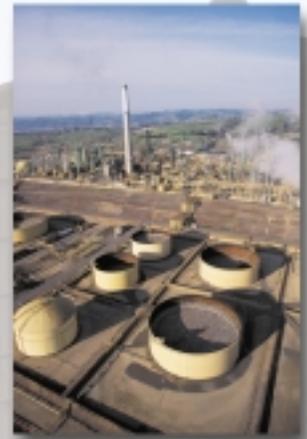
A consensus will be reached as to the importance of various parameters to be used in the computer models.

IV. Development and Implementation of the Computer Model

In order for the backflow and cross-connection problem to be addressed with the aid of the modern computer modeling techniques, we propose that three computer models be developed as part of the research project.

- Model City A (representing a population of 500,000 or more)
- Model City B (representing a population of approximately 30,000)
- Model City C (representing a population of 5,000 or less)

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Disassembling Assemblies

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same as with a suction cup. The chamber upstream of the check valve acts like the volume under the cup of the suction cup. As one tries to pull the check valve out, it is held in place by the suction upstream of the check

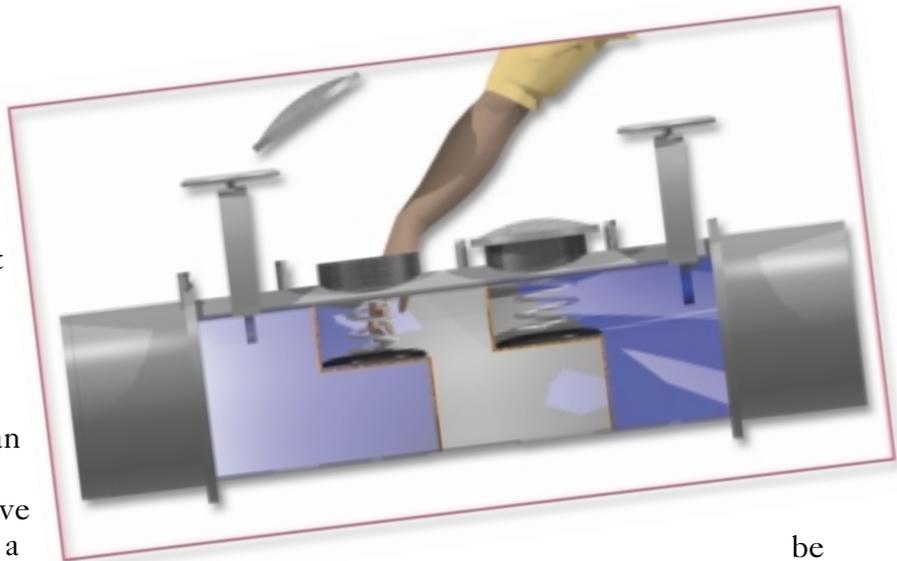
way to break the hydraulic lock—the test cocks. Simply open the test cock upstream of the check valve. This will allow air into the chamber upstream of the “stuck” check valve and break the vacuum. The tester should always

When disc compression occurs, the seat can be pushed into the rubber disc material of the check valve. If the region just upstream of the check valve is sealed (like the suction cup), a hydraulic lock can make it very difficult to remove the check. With a backflow preventer it is difficult to imagine reaching in and pulling the side of the disc up off of the seat. With most assemblies there isn't enough room to do this. Often the geometry of the assembly makes it difficult to get a good grip and apply a great amount of force to pull the check valve out. Besides, the tester doesn't really want to use very much force for fear that some components may be damaged in the process.

So, how can the tester solve this dilemma?



Unlike the suction cup, the backflow preventers have a built in



careful when opening a test cock. Once the test cock has been opened, the hydraulic lock is broken and the check valve should be easily removed. If the check valve is still very difficult to remove, the tester should not force it. This could be caused by a damaged or deformed part. The tester should be very careful not to damage the check valve or the seat in the process of trying to remove the check valve. It is not uncommon for testers to damage one of the seats of the assemblies while trying to remove or insert the check valve moving member (i.e., poppet or clapper). Seats are often made of bronze or engineered plastic, which is fairly soft in relation to other metals. If the repairperson is careless, they could damage the seat so that the check valve would leak.

If the region just upstream of the check valve is sealed (like the suction cup), a hydraulic lock can make it very difficult to remove the check.

Tenth Edition Update

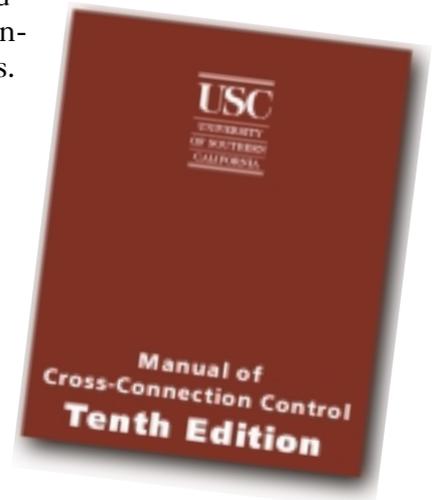
The Manual Review Committee has been working diligently on the Tenth Edition of the Manual of Cross-Connection Control. There are several items currently being developed. The Manual Review Committee welcomes any comments or suggestions for the next edition of the Manual. Comments should be submitted to the MRC through the Foundation Office or via the MRC Web Site (www.usc.edu/fccchr/mrc/). The MRC also, periodically hosts “Open Meetings.” These meetings are open to anyone who wishes to attend for observation purposes. Those wishing to present material to the MRC may do so at these meetings. However, for scheduling purposes it is necessary for those wishing to present material to the MRC should contact the Foundation in advance to be scheduled on the agenda. Those not presenting should also contact the Foundation. This will ensure that we have a large enough facility for all those attending. The next Open Meeting is scheduled for the 12th of October at the California Natural History Museum. Location details will be sent to those expressing their intention to attend the meeting.

The overall organization of the Manual will be changed. Currently the MRC intends to publish the following sections: Objectives; Definitions; Introduction/History; Hydraulics; Elements of a Cross-Connection Control Program; Cross-Connection Control Practice—Surveys; Facilities; Equipment; Sample Letters, Forms, Installation Guidelines, Model Ordinance; Field Test Procedures; Specifications of Backflow Preven-

Special Notice

The Foundation has received several questions recently regarding the Conbraco 4S-100 series backflow preventers. Advertisements and/or press releases regarding the 4S-100 series backflow preventers stated that they were “designed to comply with the USC-FCCCHR Manual.” Many assumed that this meant the assemblies were Approved. This is not the case. The Conbraco 4S-100 series of backflow preventers are NOT currently Approved by the Foundation. The Foundation has asked Conbraco to refrain from using such language in the future. Should Members ever have a question about the Approval status of an assembly, they should contact the Foundation Office.

tion Assemblies; Summary of Case Histories. The addition of the Introduction/History section, along with the Hydraulics and Elements of a Cross-Connection Control Program sections will make the Manual more versatile. The Manual is commonly used as a training tool for those learning to test backflow preventers. These additions will complement the training information helping the students to understand some of the other concepts necessary for testers to know. Those administering a cross-connection control program will benefit from the Elements of a Cross-Connection Control Program section. Those conducting site surveys will benefit greatly from the sections on Facilities and Equipment. Of course, the field test procedures along with the Specifications remain an important part of the Manual. The changes in this edition of the Manual should make it much more useful to anyone involved in cross-connection control. The MRC is trying to create a tool that will be invaluable to anyone working in the cross connection control field.



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The specific characteristics associated with each of the Model cities will be determined based on the survey data obtained from the early stages of the project. Such characteristics will include: total pipe length and the pipe diameter, flow rates, number of service connections, the pressure fluctuations in the distribution network. Different scenarios causing the loss of main line pressure will be simulated. This could be due to the breakage of a water main, fire fighting, natural disasters, such as earthquakes or floods. They will be modeled to examine the extent and the degree of backflow incidents and their potential hazards. Sensitivity of various parameters to the flow in the water distribution network will be tested and ascertained. We believe such a model will be very useful for ascertaining the effectiveness of the cross-connection control strategy.

III. Quality Assurance/ Quality Control

There are three important aspects of this research project in order to fulfill the stated goals:

- Design and conducting of the national survey
- Characterization and evaluation of the survey data
- Development of computer models applicable for large, medium and small cities

Because of the special nature of these three elements, it is important that we form a very

special quality assurance and quality control team who can assure that the methodologies used are sound and that the computer model developed utilizes the best technology and has relevance in practical applications. The quality assurance committee will be chaired by Dr. L. C. Wellford, Professor and Chairman of the Department of Civil Engineering at the University of Southern California. Dr. Wellford is a renown computer modeling expert in this nation. He is also serving on the executive committee of a FEMA sponsored project being conducted at the University of Southern California for hazard reduction of civil infrastructures due to earthquakes and other natural disasters.

The other members of the QA/QC committee will be : Dr. Masanobu Shinozuka and Dr. Sami Masri. Dr. Shinozuka is a leading authority on reliability of structural systems, lifeline systems and civil infrastructure systems. He was the Sollenberger Chair Professor of Civil Engineering at Princeton University between 1988 and 1995. He joined the faculty of the Department of Civil Engineering at the University of Southern California in 1995. He has since established a research center at USC on risk reduction for infrastructures.

Dr. Sami Masri is a Professor of Civil Engineering at the University of Southern California. He is a leading expert on structural control and computer modeling. He is the principal investigator of a large FEMA sponsored research project on hazard reduction of civil infrastructures due to earthquakes and other natural disasters.



...The specific characteristics associated with each of the Model cities will be determined based on the survey data obtained from the early stages of the project.



Dr. Jiin-Jen Lee and Paul Schwartz, the principal and co-principal investigators of the project will both sit on the QA/QC committee. However, because of their heavy involvement in conducting this proposed research, they will not be voting members so that the committee will have complete objectivity in assuring the control of quality standards. Their role will be to provide details associated with the conduct of the research so that the QA/QC committee can make informed decisions with greater efficiency.

III. Workshop II, Draft and Final Report

When we have the computer model in running order and when the survey data are evaluated and correlated we will make production runs of the computer models. A second workshop will be convened to present the semi-final results for further comment from the participating water utilities and other interested parties. We

believe, through this open exchange, we can incorporate greater input to derive a North American assessment of the impact of cross-connections. The draft will be submitted to the Quality Assurance/Quality Control Committee for review and then to AWWARF for review and comment. Final comments from AWWARF will be addressed and incorporated into the final report. We anticipate that the project will be completed in eighteen months (by April 30, 2001).

Foundation Members are encouraged to participate in this research project. Many water utilities are currently involved and many more would be welcomed to participate. Please contact the Foundation Office for more information.



List Correction

In the publication of the electronic List for publication of the Internet, the Febco 766 PVB was incorrectly listed as the 776. The correct model number is 766.

Training Courses

Tester Course

Los Angeles, CA
24-28 January 2000

Los Angeles, CA
15-19 May 2000

Los Angeles, CA
10-14 July 2000

Specialist Course

Las Vegas, NV
18-22 October 1999

Los Angeles, CA
7-11 February 2000

Los Angeles, CA
13-17 March 2000

Los Angeles, CA
24-28 July 2000

Upcoming Events

Western Regional Backflow
Conference

- Las Vegas, NV
4-6 October 1999

Manual Review Committee
Open Meeting

- Los Angeles, CA
12 October 1999

CA/NV Section AWWA Fall
Conference

- San Diego, CA
24-28 October 1999

CA/NV Section AWWA
Recycled Water Workshop

- San Diego, CA
29 October 1999

Southern California Chapter
American Backflow
Prevention Association
Conference

- Santa Maria, CA
10 November 1999



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