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Cross Talk

Autumn 2012

Detector Assemblies and Pressure Loss

Aside from the more common backflow prevention assemblies, like the double check valve backflow prevention assemblies (DC) or the reduced pressure principle backflow prevention assemblies (RP), the USC Foundation *List of Approved Backflow Prevention Assemblies* includes what are referred to as detector assemblies. These detector assemblies include the Double Check Detector Assembly (DCDA) and the Reduced Pressure Principle Detector Assembly (RPDA). Detector assemblies are used in fire sprinkler systems to detect any unauthorized use of water. Like the more common assemblies, the USC Foundation has set forth a set of standards for detector assemblies that include the allowable pressure loss across the assemblies.

The DCDA and the RPDA are each composed of a line sized assembly and a bypass assembly of the same type. A DCDA, for example contains a line sized double check valve

assembly and a bypass configuration, which includes a water meter and a bypass sized double check valve assembly.

Table 10-1 in the Tenth Edition of the *Manual of Cross-Connection Control* shows the maximum allowable pressure loss for the DC and a RP, based on the size of the assembly. However, there is not a specific listing for the detector assemblies. This is not necessary because of how the detector assemblies operate.



The detector assemblies (both the RPDA and the DCDA) are designed so that all flow, up to at least two gallons per minute, flow exclusively through the bypass arrangement

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Foundation

Membership

The Foundation's Membership Program provides many benefits to the Members of the Foundation. These include: a twenty-five percent discount on manuals, twenty percent discount on Foundation Training Courses for any employee of the Member company/organization, the *List of Approved Backflow Prevention Assemblies* with access to the up-to-the-minute version on the Foundation's website.

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.

Below is a list of those who have become members of the Foundation since the last *Cross Talk*:

Alhambra Backflow	Morristown Utility Systems
Al's Testing	North Bay Backflow
AV Water Management	Offshore Systems, Inc.
Bryan Bringham	Pacific Vista Landscape, Inc.
Buda, City of	Paknia Engineering, PC
Consolidated Supply Company	Robert Eubank
Danbury, City of	Sala1 Fire Sprinkler Services
Delta Valve and Backflow	San Dimas, City of
Don Stallsmith	San Mateo, County
Everett Leon Banks	Seattle City Light
Felixbcc	Sullivan Fire Protection Corp.
Hydro-Logic Plumbing Co.	Walker Engineering, LLC.
J Justice Plumbing, LLC.	
Josef Schmilski	
Matt-Chlor, Inc.	

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Differences among Vacuum Breakers

Backflow prevention assemblies all have very specific applications based on the degree of hazard of the water use the assembly is protecting against and the hydraulic condition in which the assembly is installed.



Pressure Vacuum Breaker

All vacuum breakers are designed to be used for backsiphonage conditions only. They may not be used in backpressure conditions. Many have made the assumption that vacuum breakers are not acceptable for protection against health hazards based solely on the fact that they may only have one check valve. This is not the case.

Vacuum breakers, both the pressure (PVB & SVB) and atmospheric vacuum breakers (AVB), are designed to protect against a health hazard under a backsiphonage condition. The name "pressure vacuum breaker" may sound like the assembly is used to protect against backpressure but, in fact, it may only be used to protect against backsiphonage. The pressure vacuum breaker is different from the atmospheric vacuum breaker, in that it may be used in a continuous pressure situation, but not a backpressure situation.

When a vacuum breaker is operating, as designed, under backsiphonage conditions, air may enter the body of the assembly to

"break" the vacuum that would be created by the backsiphonage condition. Because of this, there is a separation between the potable water on the upstream side of the assembly and the water on the downstream side of the assembly (which could possibly be contaminated). This separation ensures that the downstream water will never reach upstream of the vacuum breaker.

The pressure vacuum breaker and the atmospheric vacuum breaker do, however have some differences.



Atmospheric Vacuum Breaker

The atmospheric vacuum breaker (AVB) has a "float check" which acts as a check valve when there is no flow. Once the assembly is pressurized, the "float check" floats on the water up to the air inlet valve. It seals off the air inlet port, allowing water to flow through the AVB without discharging through the air inlet port.

The pressure vacuum breakers (PVB & SVB) are different in that it has an internally loaded check valve and a separate loaded air inlet valve. So, in this case the check valve prevents backflow and like the AVB, the air inlet valve acts to break the vacuum should the upstream pressure drop and check valve leak. The difference is that the check valve is loaded, thus providing a more positive seal (at least one psi in the direction of flow).

The air inlet valve is loaded on the PVB & SVB. This means as the pressure in the assembly drops, the air inlet will be forced open at sometime before the pressure in the body drops below 1.0 psi. The loading on the air inlet valve in the PVB & SVB allows it to be

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What invalidates a USC Foundation

The USC Foundation's *List of Approved Backflow Prevention Assemblies* is a critical tool for many in the cross-connection control field. The Foundation's evaluation of backflow prevention assemblies in the laboratory and also in the field is incredibly rigorous and detailed. Assemblies that successfully complete the laboratory and field evaluation are granted USC Foundation Approval. USC Foundation approved assemblies have shown that they meet a very high standard. Therefore, it is crucial that the USC Foundation have strict guidelines regarding replacement parts, installation orientation and modifications of USC Foundation approved assemblies, in order to keep them operating properly in the field.



To maintain the Foundation's approval it is required that all backflow prevention assemblies needing replacement parts have the parts replaced with spare parts from the original equipment manufacturer or OEM parts.

For example, a Double Check Detector Assembly (DCDA) with a malfunctioning bypass assembly can be repaired only with OEM parts. This could mean that the bypass assembly is repaired with the originally manufactured spare parts, or perhaps the bypass

assembly is completely replaced. If the latter is the case, the replacement bypass assembly must be listed on the USC Foundation's List as a replacement bypass for that specific size and model of DCDA.

Shutoff valves can be a common component in need of repair. If a RP has a bad No. 2 shutoff valve, the shutoff valve can be replaced with an identical brand, or a differential shutoff valve listed on the USC Foundation's List as acceptable for that particular assembly.

Every backflow prevention assembly has been tested and approved with specific shutoff valves and that information can be found in the "shutoffs" column of the USC Foundation's List. The use of any shutoff valve on a specific assembly, other than those listed for that specific model and size of assembly invalidates the USC Foundation's approval.

Removing parts or modifying an assembly is not acceptable. For instance, if an individual would want to remove the bypass from a DCDA but still continue to use the mainline assembly as a DC, that would invalidate the USC Foundation's approval. Detector assemblies are approved as a complete assembly including the mainline and bypass components. Removing the bypass changes the assembly from what was evaluated in the USC Foundation's laboratory and in the field. Since it is no longer the assembly evaluated by the USC Foundation, the USC Foundation's approval is invalidated.

Occasionally there are DCDA's and RPDAs approved with a bypass assembly (DC, or RP), which is no longer being manufactured. These are listed on the List as having "spare parts only." This means OEM parts are still available, even though the entire assembly is no longer being manufactured.

When these bypass assemblies, which are listed as "spare parts only," have need of repair, it is possible to repair them with OEM parts. However, it is not possible (unless this model can still be obtained) to replace the entire bypass assembly, since it is no longer being manufactured. Some field personnel have contacted the USC Foundation wishing to use a bypass assembly other than the as-

Approval?

sembly approved with the detector assembly. This would invalidate the USC Foundation's Approval. If the body of the bypass assembly is actually damaged and the bypass assembly cannot be repaired, then the entire DCDA would need to be replaced with a current USC Foundation approved DCDA assembly.

The USC Foundation's general policy is that any approved assembly may not be modified from the configuration submitted and evaluated in the laboratory and the field. This includes the orientation of the assembly.

Additionally, installation orientation of an assembly may also invalidate the USC Foundation's approval of an assembly. Installing an assembly in the vertical orientation, when it has only been approved in the horizontal orientation invalidates the USC Foundation's approval. Orientations are also listed on the USC Foundation's List for each assembly.

The USC Foundation's approval is also invalidated when an assembly is rotated on its access, or if shut-off valves are rotated, moved or removed. The only exception to this would be the rotation of flanged shutoff valves by one bolt hole on assemblies 2 ½" and larger. The Foundation has determined that this will not affect the operation of the assembly, nor of the shutoff valve.

The USC Foundation encourages anyone with any problems or questions about repairing an approved assembly and maintaining its approval to contact the Foundation's office by phone or e-mail via the Foundation's website (fccchr.usc.edu). ■

CEUs at USC Foundation Training Courses

Many certifying or licensing agencies require a certain number of continuing education units (CEU's) to be accrued every year. The USC Foundation does offer opportunities for students to earn CEU's at its training courses and soon in its new update seminars.

The USC Foundation offers two training courses, a Testers training course and a Specialists training course.

The Tester training course provides instruction for those individuals who wish to learn how to test the various backflow prevention assemblies. And, the Specialist training course teaches the intricacies of administering a cross-connection control program. All attendees of the five-day courses earn continuing education units, or contact hours.

Any student who attends the five-day Tester course is granted 3.6 CEU's or 36 contact hours. Students attending the five-day Program Specialist course are granted 3.7 CEU's or 37 contact hours.

Coming in 2013, the USC Foundation will be offering one-day update seminars. The first update seminar will be taking place on April 29, 2013. The seminar will refresh attendees on the field test procedures and diagnostics for backflow prevention assemblies according to the Tenth Edition of the *Manual of Cross-Connection Control*.

All attendees at the update seminar will be eligible for .06 CEU's the equivalent of 6 contact hours.

The USC Foundation establishes the contact hours upon the IACET Criteria and Guidelines for CEU's (Guidelines can be found on the IACET website, <http://www.iacet.org>). The guidelines identify what activities may be counted into the total contact hours and those that may not. Additionally, attendance for all technical session must be recorded with daily sign-in sheets.

The USC Foundation regularly receives requests from former students asking for either a faxed letter or a certificate stating the amount of CEU's earned at the course. Former students make these types of requests for several reasons; one may include fulfilling a requirement to maintain a certification. Former students are welcomed to enquire about the CEU's and if a certificate is requested one can be made available for a nominal fee. Students are asked to contact the USC Foundation office for more information. ■

detector assemblies and pressure loss: continued

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and register accurately on the water meter. At some point when the flow rate through the assembly is greater than two gallons per minute, the main line assembly will open, allowing water to flow freely through the mainline assembly. Water may continue to flow through the bypass and register on the meter, but the meter will no longer register accurately.

The Standards for the DCDA and the RPDA require that the mainline assembly and the bypass assembly meet all of the requirements of a double check valve assembly and reduced pressure principle assembly respectively.

ter to flow freely through the mainline assembly. But in any case, the maximum pressure loss will never exceed the maximum allowable pressure loss for a double check valve assembly, which is 10 psi regardless of the size.

The concepts are the same for the RP, but the maximum allowable pressure losses vary with the size of the assembly. For example, an 8" reduced pressure principle assembly has a maximum allowable pressure loss of 14 psi, whereas a ¾" RP has a maximum allowable pressure loss of 20 psi.

As with the DCDA the flow of water through the RPDA will, up to at least two gallons per minute, flow exclusively through the bypass arrangement and register accurately on the meter. However, because of the differences in the maximum allowable pressure losses on the RP, the maximum pressure loss across an 8" RPDA is 16 psi. The Standard 10.1.2.7.1.d allows an additional 2 psi above the values in Table 10-1.

Since general pressure loss characteristics are greater for RPs compared to DCs, the RPDA Standard had to provide a slightly higher value than the RP.

For example, if a specific model of a 8" RPDA is desired. One may look at the corresponding model of RP and determine that the pressure loss of this particular RP never exceeds 10 psi. This does not mean that the corresponding RPDA will have a maximum pressure loss of 10 psi. This is because the mainline assembly of a detector assembly is often modified from the corresponding RP assembly. Often one of the checks of the mainline RP will have a stronger loading, and thus a greater pressure loss, than the standard RP. This is part of the design in order to force the water at low flows exclusively through the bypass arrangement. So the pressure loss characteristic between an RP and RPDA may be different. The maximum allowable pressure loss for any 8" RP is 14 psi, any 8" RPDA will not have a pressure loss of more than 16 psi. ■

Table 10-1
Manual of Cross-Connection Control,
Tenth Edition

Table 10-1
Rated Flow and Maximum Allowable Pressure Loss
for Various Sizes of Backflow Prevention Assemblies

Size of the Assembly (I)	Rated Flow (I)	Maximum Allowable Pressure Loss	
		Reduced Pressure Principle Assembly (I)	Double Check Valve Assembly (I)
1/4 (6)	1*	0.06	24 (163.6)
3/8 (9)	3*	0.15	22 (151.0)
1/2 (12)	7.5*	0.47	22 (151.0)
5/8 x 3/4 *** (16-20)	20	1.20	20 (137.8)
3/4 (21)	30	1.80	20 (137.8)
1 (27)	50	3.15	18 (124.1)
1 1/4 (32)	75**	4.75	18 (124.1)
1 1/2 (36)	90	6.30	16 (110.3)
2 (48)	140	10.10	16 (110.3)
2 1/2 (65)	225**	14.25	16 (110.3)
3 (90)	320	20.10	14 (96.5)
4 (108)	360	21.55	14 (96.5)
6 (156)	500	33.10	14 (96.5)
8 (204)	600	40.00	14 (96.5)
10 (252)	750	45.15	14 (96.5)
12 (300)	900	50.30	13 (89.6)
14 (358)	1050	55.45	13 (89.6)
16 (406)	1200	60.60	13 (89.6)

* Extrapolated
** Interpolated
*** 3/4 inch inlet and outlet connections

NOTE: The pressure losses shown in Column (3) and Column (4) represent the maximum permissible pressure loss at any flow rate up to and including the rated flow shown in Column (2).

10.1.1.2.3 Standard Sizes
The following standard sizes have been adopted for backflow prevention assemblies: 1/4 inch (6 mm), 3/8 inch (9 mm), 1/2 inch (12 mm), 5/8 x 3/4 inch (16-20 mm), 3/4 inch (20 mm), 1 inch (25 mm), 1 1/4 inch (32 mm), 1 1/2 inch (36 mm), 2 inch (50 mm), 2 1/2 inch (65 mm), 3 inch (80 mm), 4 inch (100 mm), 6 inch (150 mm), 8 inch (200 mm), 10 inch (250 mm), 12 inch (300 mm), 14 inch (350 mm) and 16 inch (400 mm). All assemblies designed and constructed in sizes other than those aforementioned shall be given separate consideration.

The inlet and outlet of the assembly shall be threaded in accordance with ANSI/ASME B1.20.1 for copper pipe connections; or ANSI B16.24 for bronze flanges; or ANSI B16.1 for steel flanges; or ANSI/ASME C10.1 for grooved and flanged pipes or flared connections per SAE J153. Metric equivalents (International System of Units [SI]) have been provided wherever needed per ASTM Designation E380.

10 Standards

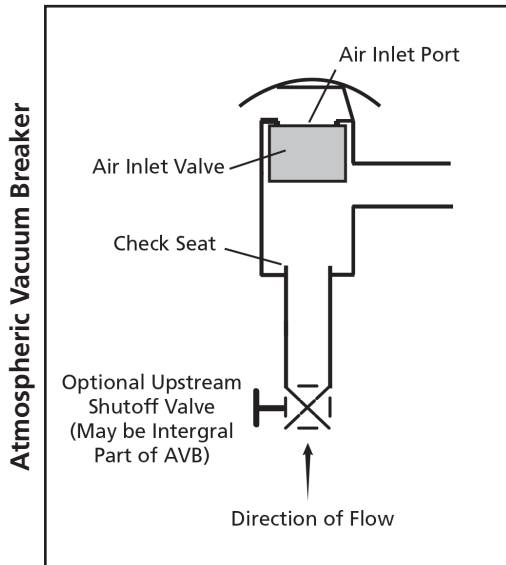
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For all double check valve assemblies, the maximum allowable pressure loss through an assembly is 10 psi. Therefore, the mainline and bypass of the DCDA must each not have a pressure loss of more than 10 psi. Water will flow through the path of least resistance. The mainline of a DCDA is often designed to have a higher-pressure loss than the comparable double check valve assembly of the same size. Being that the pressure loss is higher on the main line assembly, the water flows through the bypass, at low flows. Once the flow rate increases to some level above two gallons per minute, the check valves of the mainline assembly will open allowing wa-

pvb vs. avb: continued

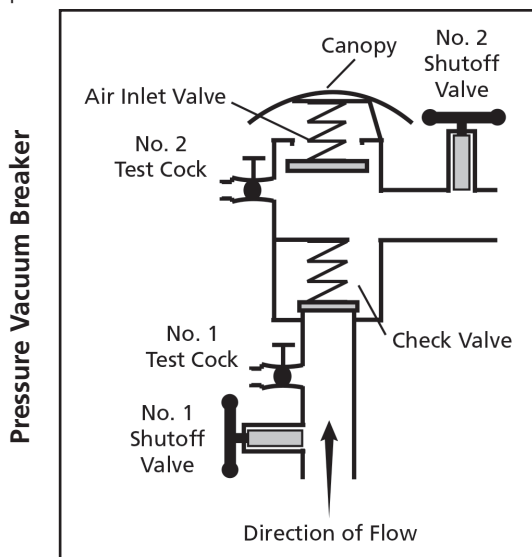
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subject to continuous pressure. The air inlet valve will break away from the air inlet opening seat because the loading on the air inlet will force the air inlet valve open.

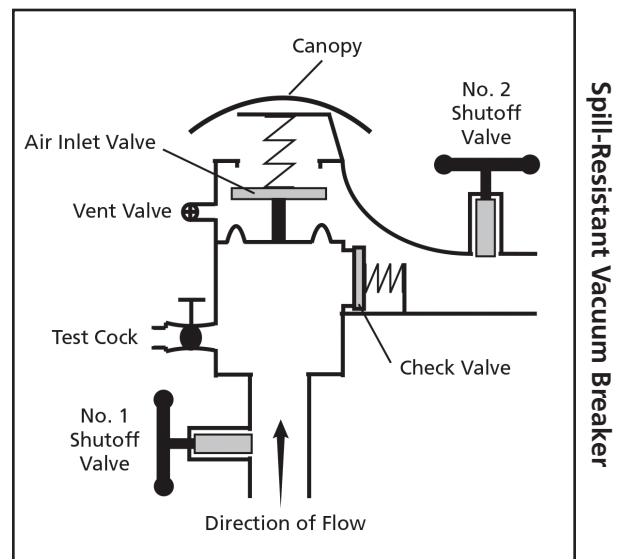


The AVB does not have this loading. Should the AVB be subjected to continuous periods of pressurization, the air inlet disc could easily adhere to the air inlet seat, thus rendering both the air inlet and the check valve components of the AVB inoperable.

This is why the AVB is not to be installed in situations where it is subjected to continuous pressure. This means the AVB cannot have shutoff valves downstream. Shutoff valves would keep the assembly under continuous pressure.



Vacuum breakers are an excellent means of preventing backflow, as long as they are installed for a suitable use. The AVB is excellent for protecting against health hazards when there is non-continuous water use (not more than twelve out of twenty-four hours). These work well on toilets and urinals; they are pressurized with each flush, and then depressurized as the water flow ceases. Laboratory sinks are another excellent use for AVBs. The sink is turned on and off regularly, but water is not left on for long periods of time. One of the most common uses of the AVB is on irrigation systems. It is common to install an AVB with an integrated shutoff valve upstream of the vacuum breaker. This works well, as the water is turned on for several minutes, and then the water is turned off, never subjecting the AVB to continuous pressure.



A PVB or SVB is needed when the system must be subjected to continuous pressure, but not backpressure. PVBs are commonly used in irrigation systems when there are solenoid valves to different zones downstream of the vacuum breaker. These valves subject the PVB to continuous pressure, where an AVB could not be used. ■

Training Courses

Tester Course

Los Angeles, CA
14-18 January 2013

Los Angeles, CA
22-26 April 2013

Specialist Course

Los Angeles, CA
18-22 March 2013

Los Angeles, CA
29 July - 2 August 2013

One-Day Update Seminar

Los Angeles, CA
29 April 2013

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Upcoming Events

Oregon ABPA
Annual Seminar
Clackamas, OR
24 January 2013

Utah ABPA
Annual Conference
Salt Lake City, UT
7 February 2013

Nebraska ABPA
Regional 12 Conference
Kearney, NE
6 March 2013

Contact Information

Phone: 866-545-6340

Fax: 213-740-8399

E-mail: fccchr@usc.edu

Website: fccchr.usc.edu

**Foundation for
Cross-Connection Control
and Hydraulic Research**

University of Southern California
Kaprielian Hall 200
3620 South Vermont Avenue
Los Angeles, California 90089-2531

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US Postage PAID
University of
Southern California