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Foundation for
Cross-Connection
Control and
Hydraulic Research

To: Manufacturers of backflow prevention assemblies

From: Paul Schwartz, Chief Engineer

Date: 29 August 2007

Subject: Revision - Evaluation Policy 07-001-R1
Backpressure and Backsiphonage Test

This memo is to notify the manufacturers of backflow prevention assemblies that the Foundation Engineering Staff is issuing a revision (R1) of the Evaluation Policy 07-001.

The attached backpressure/backsiphonage test contained in Evaluation Policy 07-001 was implemented starting 23 May 2007. Effective immediately, any backflow prevention assemblies submitted for Laboratory Evaluation under the 9th Edition may be evaluated according to the current test protocol contained in the 9th Edition, or the protocol detailed in this Evaluation Policy, at the option of the manufacturer. If the specific test protocol is not designated by the manufacturer, the Foundation shall perform the protocol in this Evaluation Policy.

Should you require any additional information, please contact our Laboratory Staff.

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Manual of Cross-Connection Control - 9th Edition

Evaluation Policy 07-001-R1
Backpressure/Backsiphonage Test
07-001 Issued 23 May 2007 (Revision R1 issued 29 August 2007)

Standard
for
Reduced Pressure Principle Assemblies (Section 10.2.2)

The test below replaces the existing Section 10.2.2.3.8

Purpose: To determine if simultaneous backsiphonage and backpressure conditions coupled with leaking No. 1 and No. 2 check valves will permit the carry over of water from the downstream piping into the upstream piping.

Requirement: There shall be no backsiphonage of water from the downstream piping through No. 1 and No. 2 check valves under conditions of up to 25 inches of mercury vacuum (16.89 KPa) in the supply piping and a backpressure condition of 1psi (6.89 KPa).

Steps:

a. Remove the moving members (i.e., poppet or clapper) from the No. 1 and the No. 2 check valves. Maintain the No. 1 and No. 2 shutoff valves in the fully open position.

b. Install upstream and downstream of the assembly under test, orifices equivalent to the Table below. Orifices shall comply with ASME/ANSI MFC-14M-2003[1] and the downstream orifice shall be located a minimum of five (5) pipe diameters from the No. 2 shutoff valve. The resulting flow of water through the downstream orifice shall be normal to the pipeline.

c. The assembly shall be subjected to a downstream condition of 1 psi (6.89 KPa).

d. With the backpressure established as in step "c" above, the assembly shall then be subjected to an upstream condition of 25 inches of mercury vacuum (16.89 KPa absolute).

[1] ASME. Measurement of Fluid Flow Using Small Bore Precision Orifice Meters – 2003.

e. The vacuum pressure is to be slowly imposed (20 seconds ± 5 seconds) and maintained for five (5) minutes. Any amount of water collecting in the upstream transparent tube shall be cause for rejection.

f. The 25 inches of mercury vacuum (16.89 KPa absolute) is to be shock applied (by means of a quick opening valve) for five (5) cycles and any amount of water collecting in the upstream transparent tube shall be cause for rejection.

g. The assembly shall be inspected for any damage due to the above vacuum tests. Any damage or permanent deformation shall be cause for rejection.

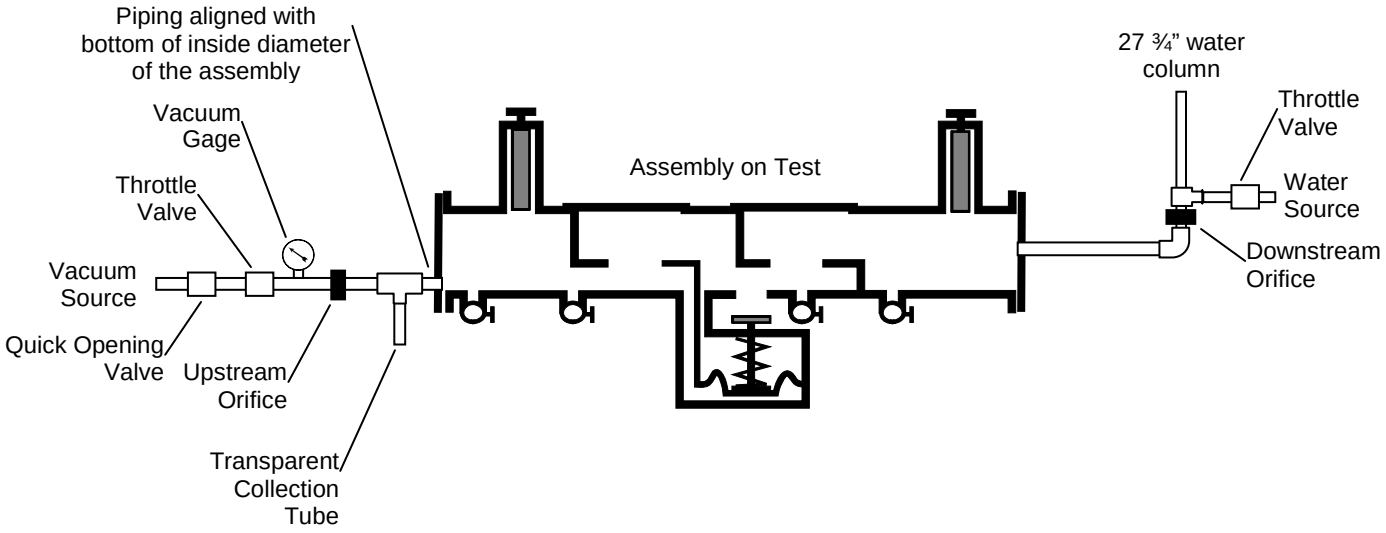
h. If a drain funnel is provided, tests *e* through *f* shall be repeated with the manufacturer's drain funnel attached to the assembly. Evidence of any amount of water collecting in the upstream transparent tube shall be cause for rejection.

TABLE

SIZE OF ORIFICES FOR BACKPRESSURE/BACKSIPHONAGE TEST Section 10.2.2.3.8

Size of Assembly		Upstream Orifice (Backsiphonage)		Downstream Orifice (Backpressure)	
(inches)	(mm)	(inches)	(mm)	(inches)	(mm)
½ and below	12	0.032	0.81	0.032	0.81
5/8 x ¾	16 x 20	0.032	0.81	0.040	1.01
¾	20	0.032	0.81	0.040	1.01
1	25	0.040	1.01	0.048	1.22
1 ¼	32	0.048	1.22	0.056	1.42
1 ½	40	0.056	1.42	0.064	1.62
2	50	0.064	1.62	0.080	2.03
2 1/2	65	0.080	2.03	0.096	2.44
3	80	0.096	2.44	0.112	2.84
4	100	0.144*	2.84	0.144	3.66
6	150	0.144*	3.66	0.210	5.33
8	200	0.210*	5.33	0.275	6.98
10	250	0.210*	6.98	0.340	8.64
12	300	0.340	8.64	0.400	10.16
14	350	0.400	10.16	0.460	11.68
16	400	0.460	11.68	0.525	13.34

*NOTE: Since the relief discharge rates are the same for the 4"/6" and 8"/10" assemblies, the backsiphonage orifice will be the same for these pairings.

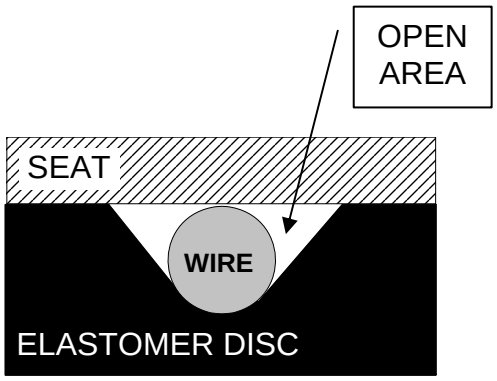


Backsiphonage/Backpressure Test System
Diagrammatic sketch showing location of system components

Development background for protocol in Evaluation Policy 07-001-R1

At the February 2006 Open Manual Review Committee (MRC) meeting, several of the manufacturer representatives requested that the Foundation reconsider the 12/15/05 draft of the proposed backsiphonage/backpressure test protocol. It had been found by some of the manufacturers that some of the currently Approved RP's would not comply with the proposed 10th Edition protocol. During the February 2006 MRC meeting, the manufacturers were asked to perform in-house testing of their own products, and provide the data to the Foundation Staff for review. Some data was provided to the Staff, with recommended modifications to the parameters of the test. These recommendations were primarily lowering the effective air flow capacity of the test. The Staff took this data into consideration during their review of the test protocol. Some of the specific points reviewed included the actual flow rate (SCFM) of air flowing through a fouled first check valve, and the actual flow rate (gpm) of water flowing through a fouled second check valve.

The Staff concluded that the proposed air flow rates of the original draft protocol could be reduced, and still maintain the intent of the test. When performing the test with fouling wires, the air flow would pass through the open area created by the fouling wire embedding in the elastomer disc. (*see illustration at right*) Since the first check valve of the RP has a loading 5-10 times greater than the second check valve, the amount of embedding is significantly greater in the first check valve. Since the fouling wire in the second check valve may not embed as far, this produces a larger open area.



The theoretical open area around the fouling wire in the first check valve was calculated and found to be approximately the same effective diameter as the next smaller fouling wire size contained in Table 10-6 of the 9th Edition. So the size of the upstream orifice (for backsiphonage) contained in the new protocol will correspond with the diameter of the next smaller sized fouling wire. The air flow rates produced by the orifice of the next smaller diameter compare relatively close to the air flow rates recommended to the Staff.

During the experimental testing of the new protocol, variable-area flowmeters were used to measure the air flow in SCFM/SCFH. Under some air flow measurements the float in the flowmeter would tend to oscillate due to pulsating flows. This appeared to be due to the fluctuating flows through the relief valve port caused by the exiting water and entering air. To minimize the measurement errors caused by the pulsating flows, the Staff concluded that the use of the orifice plates would

produce a more repeatable test protocol. Therefore, the vacuum conditions will be imposed on the upstream orifice as detailed in the table in Evaluation Policy 07-001.

The table below compares some of the resulting air flows from the original 10th Edition draft dated 12/15/05; the proposed values submitted from two manufacturers; and the values from the Evaluation Policy 07-001.

SIZE OF ASSEMBLY	AIR FLOW (SCFM)			
	USC 10th ED. DRAFT 12/15/05	MANUF. PROPOSED VALUES (MAY 2006)	USC REVISED (07-001)	REVISED UPSTREAM ORIFICE SIZE
2-1/2	1.8	2	1.25	0.096
3	2.2	2	1.80	0.112
4	4.3	3	4.30	0.144
6	8.5	4	4.30	0.144
8	16	6	8.5	0.210
10	24	6	8.5	0.210
12		6	23	0.340

A draft copy of the Evaluation Policy 07-001 was sent to the manufacturers for review and comment on 26 April 2007. Recommendations received from this comment period have been incorporated into the final policy, including:

- Procedure Step 'a' : Remove the moving member (i.e., poppet or clapper) from the No. 1 and the No. 2 check valves ~~shall be held in the fully open position~~. Maintain the No. 1 and No. 2 shutoff valves in the fully open position.
    - *Removal of the moving member is consistent with other tests in the Standard.*

- Diagrammatic sketch: Clarification of piping arrangement on upstream side of assembly. Removed the moving members (i.e., poppet or clapper) from the assembly illustration.

Evaluation Policy 07-001 issued 23 May 2007, which stated that only those products *currently queued* for evaluation would have the option of which test to perform.

Revision (R1) of Evaluation Policy 07-001 issued 29 August 2007. No changes in the steps of the protocol were made, only the submittal criteria. All assemblies submitted for evaluation under the 9th Edition may be evaluated according to the test protocol contained in the 9th Edition, or the protocol detailed in this Evaluation Policy, at the option of the manufacturer. If the specific test protocol is not designated by the manufacturer, the Foundation shall perform the protocol in this Evaluation Policy.