Summary of Substantive Changes
Between the 2011 and the 2021 editions of
ASSE 1015 "Double Check Backflow Prevention"

Presented to the IAPMO Standards Review Committee on September 12, 2022

General: The changes to this standard may have an impact on currently listed products. The substantive changes are:

- Removing a previous category of devices referred to as Double Check Fire Protection Backflow Preventers throughout the Standard that are no longer in use.
- Revised multiple test procedures for clarification (see Sections 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, and 3.10)
- Added Table 2 for clarification of Section 1.3.2.5 for test cock sizes and connection (see Section 1.3.2.5, and Table 2)

Standard Title was revised as follows:
Double Check Backflow Prevention Assemblies ~~and Double Check Fire Protection Backflow Prevention Assemblies~~

Section I
1.1 Application
The purpose of a Double Check Backflow Prevention Assembly (DC) ~~and a Double Check Fire Protection Backflow Prevention Assembly (DCF)~~ (herein referred to as the "assembly") is to keep polluted water from flowing into a potable water distribution system when some abnormality in the system causes the pressure to be temporarily higher in the polluted part of the system than in the potable water supply piping.
1.2 Scope
1.2.1 Description
~~This standard applies to two types of backflow prevention assemblies identified as:~~
~~(a) Double Check Backflow Prevention Assembly (DC); and~~
~~(b) Double Check Fire Protection Backflow Prevention Assembly (DCF).~~

These assemblies consist of ~~two (2)~~2 independently acting check valves, internally force loaded to a normally closed position, ~~two (2)~~2 properly located tightly closing shut-off valves per Section 1.3.2.6 and properly located test cocks per Section 1.3.2.4. These assemblies are designed and constructed to operate under intermittent or continuous pressure conditions.
~~This standard also applies to Manifold Double Check Backflow Prevention Assemblies consisting of two (2) or more complete Double Check Backflow Prevention Assemblies in parallel. The assemblies do not need to be of the same pipe size. The manifold size shall be identified by the single inlet and outlet of the manifold assembly. Manifold Double Check Backflow Prevention Assemblies shall include line-sized shut-off valves on each inlet and outlet of the assemblies making up the manifold.~~

1.2.3 ~~Rated~~ Pressure Rating
The maximum working pressure shall be at least 175 psi (1206.6 kPa).
*~~**1.2.3.1** A DC assembly shall be designed for a working pressure of at least 150.0 psi (1034.2 kPa).~~*

~~**1.2.3.2** A DCF assembly shall be designed for a working pressure of at least 175.0 psi (1206.6 kPa).~~

1.2.4 Temperature Range

~~The assemblies shall be designed for a minimum temperature range of 33.0°F to 140.0°F (0.6°C to 60.0°C).~~
Assemblies for cold water applications shall be designed for a minimum temperature range of 33.0°F to 140.0°F (0.6°C to 60.0°C).
Assemblies for hot water applications shall be designed for a minimum temperature range of 33.0°F to 180.0°F (0.6°C to 82.2°C).

1.3.2.4 Test Cock Location

Test cocks shall be provided in the following locations:
a) On the supply side of the inlet shut-off valve ~~(not required on any sizes of DCF assemblies)~~.
b) Between the inlet shut-off valve and the first check valve.
c) Between the checks valves~~s~~.
d) Between the second check valve and the outlet shut-off valve

1.3.2.5 Test Cock Size Inlet and Outlet Connection

~~For assemblies up to and including 1 inch (25 mm) pipe size, a~~ The minimum inlet and outlet thread on the test cocks shall be ~~⅛ NPT or SAE J513 ¼. For assemblies 1¼ inch – 2 inch (32 mm – 50 mm), a minimum inlet and outlet thread on the test cocks shall be ¼ NPT. For assemblies 2½ inch – 4 inch (65 mm – 100 mm), a minimum inlet and outlet thread on the test cocks shall be ½ NPT. For assemblies 6 inch (150 mm) and larger, a minimum inlet and outlet thread on the test cocks shall be ¾ NPT~~ per Table 2. Test cock waterways shall be full port. Protective caps shall be provided on SAE test cocks to protect male outlet threads.

1.3.2.6 Shut-off Valves

a) Shut-off valves shall be provided at the inlet and outlet of the assembly.
b) Shut-off valves shall be resilient seated.
~~c) For type DCF assemblies, the shut-off valves shall be UL or FM listed or approved for use in fire protection systems.~~
~~d~~c) The #1 shut-off is located at the inlet side of the assembly.
~~e~~d) The #2 shut-off is located at the outlet side of the assembly.

1.4 Reference Standards

- ASME B16.24-~~2006~~2016, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500 and 2500
- ASME B1.20.1-~~1983~~2013 (R~~2006~~2018), Pipe Threads, General Purpose (Inch)
- ASME B1.20.3-1976 (R~~2008~~2018), Dryseal Pipe Threads (Inch)
- ASSE 1060-~~2006~~2017, Performance Requirements for Outdoor Enclosures for Fluid Conveying Components
- ASSE Series 5000-~~2009~~2015, Cross-Connection Control Professional Qualification Standard
- ASTM A 126-04 (~~2009~~2019), Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- ASTM A 536-84 (~~2009~~2019), Standard Specification for Ductile Iron Castings
- AWWA C606-~~06~~15, Grooved and Shouldered Joints
- CFR Title 21, Section 177-2016, Food and Drugs: Indirect Food Additives: Polymers

- *SAE J513-~~1999~~2019, Refrigeration Tube Fittings – General Specifications*
- *University of Southern California Foundation for Cross-Connection Control & Hydraulic Research, Manual of Cross-Connection Control, Tenth Edition*
- *UL 312-~~2010~~2018, Check Valves for Fire-Protection Service*

~~*American Society of Mechanical Engineering (ASME) Three Park Avenue New York, NY 10016*~~
~~*American Society of Sanitary Engineering (ASSE) 901 Canterbury Road, Suite A Westlake, OH 44145*~~
~~*ASTM International (ASTM) 100 Barr Harbor Drive West Conshohocken, PA 19428-2959*~~
~~*American Water Works Association (AWWA) 6666 West Quincy Avenue Denver, CO 80235*~~
~~*Code of Federal Regulations (CFR) Superintendent of Documents, U. S. Government Printing Office Washington, DC 20402*~~
~~*FM Global (FM) 270 Central Avenue Johnston, RI 02919*~~
~~*International Society of Automation (ISA) 67 Alexander Drive Research Triangle Park, NC 27709*~~
~~*SAE International (SAE) 400 Commonwealth Drive Warrendale, PA 15096-0001*~~
~~*Underwriters Laboratories Inc. (UL 333 Pfingsten Road Northbrook, IL 60062*~~
~~*University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USC FCCC&HR) 3022 Riverside Drive Los Angeles, CA 90039*~~

Section 2.0 Test Specimens

2.1 Samples Submitted for Test

~~*Three (3) assemblies of each type and model for sizes ¼ inch – 2 inch (6 mm – 50 mm) and one (1) assembly sized 2½ inch (65 mm) and larger shall be submitted by the manufacturer to the testing laboratory for evaluation.*~~

Tests shall be performed in the order listed on 1 assembly of each model and size submitted.

2.1.1 *For alternate orientations, additional samples may be submitted. Once the primary orientation assembly has completed and passed all Section III tests, ~~the additional samples for an~~ each alternate orientation(s) shall be tested ~~for each alternate orientation~~ to all the following sections:*

a) 3.1, Independence of Components

b) 3.5, Allowable Pressure Loss

2.1.2 *If the orientation of either of the check valves changes from the primary to an alternate orientation, the assembly shall also be tested to all the following sections:*

a) 3.4, Hydrostatic Backpressure Test of Check~~s~~ Valve

b) 3.6, Drip Tightness of First Check Valve

c) 3.7, Drip Tightness of the Second Check Valve

2.1.3 *For assemblies with alternate shut-off valves, that assembly shall be tested to the following sections:*

a) 3.2, Hydrostatic Test of Complete Assembly

b) 3.3, Seat Leakage Test for Shut-off Valves

c) 3.5, Allowable Pressure Loss

~~***2.5 Manifold Assembly***~~

~~*A manifold assembly shall be tested per Sections 3.2, Hydrostatic Test of Complete Assembly, and 3.5, Allowable Pressure Loss at Rated Flow. The individual assemblies that make up the manifold shall meet all of the test sections of the standard in their intended orientation based on the nominal pipe size for each individual assembly.*~~

Section III

3.0 Performance Requirements and Compliance Testing

3.1 Independence of Components

3.1.1 Purpose

The purpose of this test is to determine that the shut-off valves and check~~s~~ valve operate without interfering with each other.

3.1.2 Procedure

Verify that the shut-off valves and check~~s~~ valve do not interfere with one another through their full range of travel.

3.1.3 Criteria

Any interference of one component with another component shall result in a rejection of the assembly.

3.2 Hydrostatic Test of Complete Assembly

3.2.1 Purpose

The purpose of this test is to determine if the assembly withstands pressures of ~~two (~~2~~)~~ times the manufacturer's maximum working pressure without leakage or damage to the assembly.

3.2.2 Procedure

1. Seal the inlet and the outlet of the assembly.

2. Fully open the assembly's #1 and #2 shut-off valves.

3. Slowly pressurize the assembly through test cock #1 or #2, purge the assembly of air, then ~~and~~ hold a pressure of ~~two (~~2~~)~~ times the manufacturer's maximum ~~rated~~ working pressure or 350 psi, whichever is greater, for ~~ten (~~10~~)~~ minutes. ~~The assembly's shut-off valves shall be in the full open position.~~

4. Isolate pressure source and open test cock #4 to relieve pressure.

3.2.3 Criteria

Any ~~external leaks~~ leakage or damage which prevents full compliance with the remainder of this standard shall result in a rejection of the assembly.

3.3 Seat Leakage Test for Shut-off Valves

3.3.1 Purpose

The purpose of this test is to determine the shut-off valves' capability to withstand a test pressure of ~~two (~~2~~)~~ times the manufacturer's maximum working pressure in the closed position without leaking.

3.3.2 Procedure

~~NOTE: Non-integral shut-off valves shall be removed for this test.~~

3.3.2.1. Procedure for the #1 Shut-off Valve

1. ~~With the~~ Close #1 shut-off valve ~~in the closed position~~.

2. Remove access cover(s) to remove check valves.

3. Slowly increase the pressure during a ~~one (~~1~~)~~ minute period on the inlet side of the assembly from ~~zero (~~0~~)~~ psi to twice the manufacturer's maximum ~~rated~~ working pressure of the assembly. Hold the pressure for ~~ten (~~10~~)~~ minutes.

4. With full view of #1 shut-off valve sealing member, observe for leakage into the assembly. ~~Repeat the test, pressurizing the outlet side from zero (0) psi to twice the manufacturer's maximum rated pressure of the assembly.~~

3.3.2.2 Procedure for the #2 Shut-off Valve

~~If the sealing mechanism is different between the #1 shut-off valve and the #2 shut-off valve, repeat Section 3.3.2.1 on the #2 shut-off valve.~~

1. Close #2 shut-off Valve.

2. Slowly increase the pressure during a 1 minute period on the outlet side of the assembly from 0 psi to twice the manufacturer's maximum working pressure of the assembly.

3. Hold the pressure for 10 minutes. With full view of #2 shut off sealing member, observe for leakage into the assembly.

3.4 Hydrostatic Backpressure Test of Check Valves

3.4.1 Purpose

The purpose of this test is to determine if the checks withstand pressures of ~~two (~~2~~)~~ times the manufacturer's maximum ~~rated~~ working pressure without leaking or damage to the assembly.

3.4.2 Procedure – First Check Valve

~~Seal the inlet and outlet of the assembly. The assembly's shut-off valves shall be in the open position. Install a sight glass in test cock #2 upstream of the first check. Purge the assembly of air. Open test cock #2 to the sight glass. Apply the test pressure at test cock #3. The height of the water in the sight glass shall be adjusted to be 6 inches (152 mm) above the top of the water space in the assembly. Raise the pressure at test cock #3 to twice the manufacturer's maximum rated working pressure. Record the water level in the sight glass. Hold the pressure for ten (10) minutes.~~

1. Seal the inlet and outlet of the assembly.
2. Fully open both the #1 and #2 shut-off valves. Verify all test cocks are closed.
3. Pressurize and purge the assembly of air. Install a sight glass to test cock #2.
4. Open test cock #2 to the sight glass to fill to a height of 6.0 inches (152mm) above the top of the assembly.
5. Close supply of water.
6. Connect the water supply to test cock #3 and open test cock #3.
7. Raise the pressure at test cock #3 to twice the manufacturer's maximum working pressure or 350 psi (2413 kPa), whichever is greater.
8. Hold the pressure for 10 minutes, while observing water level in the sight glass.
9. Isolate the assembly from pressure. Close test cock #2.

3.4.3 Procedure – Second Check Valve

~~Install the sight glass in test cock #3. Adjust the water level in the sight glass to be 6 inches (152 mm) above the top of the water space in the device. Apply a pressure through test cock #4 of twice the manufacturer's maximum rated working pressure on the downstream side of the second check. Record the water level in the sight glass. Hold the pressure for ten (10) minutes.~~

The overflow opening cannot be used for the critical level if:
1. Depressurize the assembly to atmospheric pressure by opening and closing test cocks #2, #3, and #4.
2. Install the sight glass to test cock #3. Open test cock #3 to fill to a height of 6.0 inches (152mm) above the top of the assembly.
3. Connect the water supply to test cock #4 and open test cock #4.
4. Raise the pressure at test cock #4 to twice the manufacturer's maximum working pressure or 350 psi (2413 kPa), whichever is greater.
5. Hold the pressure for 10 minutes, while observing the water level in the sight glass.
6. Isolate assembly from pressure source and depressurize assembly through test cock #4.

3.4.4 Criteria

Any evidence of leakage at the sight glass or indications of damage which prevents full compliance with the remainder of this standard shall result in a rejection of the assembly.

3.5 Allowable Pressure Loss ~~at Rated Flow~~

3.5.1. Purpose

The purpose of this test is to determine the maximum pressure loss through the assembly at any flow from ~~zero (~~0~~)~~ gpm to the rated flow. ~~In addition, for DCF assemblies only, the purpose of this test is to determine if the pressure drop through the assembly generally increases from zero (0) flow to a flow of 50.00 GPM (3.15 L/s).~~

3.5.2. Procedure

1. Install the assembly per Figure 1 with a manometer or differential pressure gauge at P1 and P2.

2. The supply source shall be capable of supplying a volume of water adequate to meet the flow requirements of the size of assembly on test and maintain an inlet pressure of at least 10 psi (68.9 kPa) greater than the allowable pressure loss in Table 1.
3. The pressure loss through the piping between the shut-off valves of the assembly on test and the gauges at P1 and P2 shall be subtracted from the differential pressure reading at P1 and P2.
4. Pressurize and purge the system of air. Gradually increase the flow of water through the assembly until the required rated flow of water is achieved per Table 1. Record maximum pressure loss observed as well as pressure loss at rated flow.
5. Increase the flow to 150% of the rated flow shown in Table 1 and record the differential pressure.
6. Increase the flow to 200% of the rated flow shown in Table 1 and hold for 5 minutes; then record the differential pressure.
7. Gradually decrease the flow of water to 0 gpm.

~~***3.5.2.1 DC Assemblies***~~

~~*Install the assembly per Figure 1 with a manometer or differential pressure gauge at gauge connections #1 and #2. These shall connect to ring piezometers per ISA 75.02. The supply source shall be capable of supplying a volume of water adequate to meet the flow requirements of the size of assembly on test and maintain an inlet pressure of at least 10.0 psi (68.9 kPa) greater than the allowable pressure loss at rated flow. The pressure loss through the piping between the shut-off valves of the assembly on test and the gauges at gauge connections #1 and #2 shall be subtracted from the differential pressure reading at gauge connections #1 and #2. Purge the system of air; then gradually increase the flow of water through the assembly until the required rated flow of water is achieved, per Table 1. Gradually decrease the flow of water to zero (0).*~~

~~***3.5.2.2 DCF Assemblies***~~

~~*Install the assembly per Figure 1 with a manometer or differential pressure gauge at gauge connections #1 and #2. These shall connect to ring piezometers per ISA 75.02. The supply sourceshall be capable of supplying a volume of water adequate to meet the flow requirements of the size of assembly on test and maintain an inlet pressure of at least 10.0 psi (68.9 kPa) greater than the allowable pressure loss at rated flow. The pressure loss through the piping between the shut-off valves of the assembly on test and the gauges at gauge connections #1 and #2 shall be subtracted from the differential pressure reading at gauge connections #1 and #2. Purge the system of air. The pressure loss at flow shall be measured at increments of 5.00 GPM (0.32 L/s), starting at zero (0) flow up to 50.00 GPM (3.15 L/s). Gradually increase the flow of water through the assembly until the required rated flow of water is achieved, per Table 1. Increase the flow to 150% of the rated flow shown in Table 1 and record the differential pressure. Increase the flow to 200% of the rated flow shown in Table 1 and hold for five (5) minutes; then record the differential pressure. Gradually decrease the flow of water to zero (0)*~~

~~***3.5.3 Procedure – DC Manifold Assemblies***~~

~~*The rated flow for a manifold assembly shall be per Table 1; the inlet and the outlet of the manifold shall identify its size. During the flow test, while still at 200% of rated flow per Table 1, alternately close and open shut-off valve #2 of each of the assemblies in the manifold, causing the flow to pass through each assembly in the manifold individually for five (5) minutes.*~~

~~***3.5.3.1 Manifold - DC Assemblies***~~

~~*Install the assembly per Figure 1 with a manometer or differential pressure gauge at gauge connections #1 and #2. These shall connect to ring piezometers per ISA 75.02. The supply source shall be capable of supplying a volume of water adequate to meet the flow requirements of the size of assembly on test and maintain an inlet pressure of at least 10.0 psi (68.9 kPa) greater than the allowable pressure loss at rated flow. The pressure loss through the piping*~~
~~*between the shut-off valves of the assembly on test and the gauges at gauge connections #1 and #2 shall be subtracted from the differential pressure reading at gauge connections #1 and #2. Purge the system*~~

~~of air; then gradually increase the flow of water through the assembly until the required rated flow of water is achieved, per Table 1. Increase the flow to 150% of the rated flow shown in Table 1 and record the differential pressure. Increase the flow to 200% of the rated flow shown in Table 1 and hold for five (5) minutes; then record the differential pressure. Gradually decrease the flow of water to zero (0).~~

~~**3.5.3.2 Manifold DCF Assemblies**~~

~~Install the assembly per Figure 1 with a manometer or differential pressure gauge at gauge connections #1 and #2. These shall connect to ring piezometers per ISA 75.02. The supply source shall be capable of supplying a volume of water adequate to meet the flow requirements of the size of assembly on test and maintain an inlet pressure of at least 10.0 psi (68.9 kPa) greater than the allowable pressure loss at rated flow. The pressure loss through the piping between the shut-off valves of the assembly on test and the gauges at gauge connections #1 and #2 shall be subtracted from the differential pressure reading at gauge connections #1 and #2. Purge the system of air. The pressure loss at flow shall be measured at increments of 5.0 GPM (0.32 L/s), starting at zero (0) flow up to 50.00 GPM (3.15 L/s). Gradually increase the flow of water through the assembly until the required rated flow of water is achieved, per Table 1. Increase the flow to 150% of the rated flow shown in Table 1 and record the differential pressure. Increase the flow to 200% of the rated flow shown in Table 1 and hold for five (5) minutes; then record the differential pressure. Gradually decrease the flow of water to zero (0).~~

~~3.5.4~~ 3.5.3 Criteria

a) The occurrence of pressure loss greater than those shown in Table 1 at flows from 0 gpm to rated flow (both ascending and descending) shall result in a rejection of the assembly.

~~(b) Failure of the pressure drop through the DCF assembly to generally increase from static up to a flow of 50.00 GPM (3.15 L/s) with a maximum total downward deviation of 10% from the highest previous value at any point shall result in a rejection of the assembly.~~

~~c~~*b) Any damage or permanent deformation of the internal components shall result in a rejection of the assembly.*

3.6 Drip Tightness of First Check Valve

3.6.1 Purpose

The purpose of this test is to determine if the first check valve prevents flow with an inlet pressure at 1 psi (6.9 kPa), and the outlet pressure at atmospheric.

3.6.2 Procedure

~~Install a sight glass in test cocks #2 and #3. Purge the system of air, and open the test cocks to the sight glasses. With the #2 shut-off valve on the assembly closed and test valve #4 open, pressurize the inlet of the assembly until there is water filling the sight glass column at test cock #2 to at least 42 inches (1069 mm) measured above the water level in the sight glass at test cock #3. Close the supply valve tightly. Wait for ten (10) minutes. When no further fall of water is observed in the sight glass at test cock #2, record the difference in the water levels between sight glasses at test cocks #2 and #3.~~

1. Install the assembly per Figure 1.

2. Install a sight glass at test cocks #2 and #3.

3. Pressurize and purge the assembly of air. Close the #2 shut-off valve.

4. Open the test cocks to the sight glasses.

5. Adjust the inlet pressure of the assembly until there is water filling the sight glass at test cocks #2 to at least 42 inches (1067 mm) measured above the water level in the sight glass at test cock #3.

6. Close the supply valve tightly.

7. When no further fall of water is observed in the sight glass at test cock #2. Record the difference in the water levels between sight glasses at test cocks #2 and #3.

3.6.3 Criteria

A height difference of less than 28 inches (711 mm) between the water level in the sight glasses shall result in a rejection of the assembly.

3.7 Drip Tightness of Second Check Valve

3.7.1 Purpose

The purpose of this test is to determine if the second check valve prevents flow with an inlet pressure at 1~~.0~~ psi (6.9 kPa), and the outlet pressure at atmospheric.

3.7.2 Procedure

~~Install a sight glass in test cocks #3 and #4. Purge the system of air and open the test cocks to the sight glasses. With the #2 shut-off valve on the assembly closed and test valve #2 open, pressurize the inlet of the assembly until there is water filling the sight glass column at test cock #3 to at least 42 inches (1069 mm) measured above the water level in the sight glass at test cock #4. Close the supply valve tightly. Wait ten (10) minutes. When no further fall of water is observed in the sight glass at test cock #3, record the difference in the water levels between sight glasses at test cocks #3 and #4.~~

1. Install the assembly per Figure 1.

2. Install a sight glass at both test cocks #3 and #4.

3. Pressurize and purge the assembly of air. Close shut-off valve #2.

4. Open the test cocks to the sight glasses.

5. Adjust the inlet pressure of the assembly until there is water filling the sight glass column at test cock #3 to at least 42 inches (1067 mm) measured above the water level in the sight glass at test cock #4.

6. Close the supply valve tightly.

7. When no further fall of water is observed in the sight glass at test cock #3, record the difference in the water levels between sight glasses at test cocks #3 and #4.

3.7.3 Criteria

A height difference of less than 28 inches (711 mm) between the water level in the sight glasses shall result in a rejection of the assembly.

3.8 Deterioration at Manufacturer's Extremes of *Temperature and Pressure Ranges*

3.8.1 Purpose

The purpose of this test is to verify that when exposed to water at extremes of manufacturer's maximum working temperature at its maximum ~~rated~~ working pressure, the assembly continues to meet the performance requirements of this standard.

3.8.2. Procedure

*~~**3.8.2.1**~~ **1.** Test ~~A~~assemblies ~~shall be tested~~ at 40.0 °F +0/-7(4.4 °C +0/-3.9); and at the manufacturer's maximum ~~rated~~ working temperature.*

2. Install the assembly as in Figure 1.

3. Circulate ~~W~~water at the manufacturer's maximum ~~rated~~ working temperature and maximum ~~rated~~ working pressure ~~shall be circulated~~ through the assembly at a flow rate per Table ~~2~~3 for ~~one-hundred~~ ~~(~~100~~)~~ hours.

4. Upon completion of the 100 hours, ~~W~~while still at temperature, test the assembly to:

a) Section 3.6, Drip Tightness of First Check Valve; and

b) Section 3.7, Drip Tightness of Second Check Valve.

*~~**3.8.2.4**~~ **5.** ~~Upon completion of the one-hundred (100) hours, f~~Flow ambient temperature water through the assembly. Once the assembly reaches ambient temperature, retest the assembly to:*

a) Section 3.2, Hydrostatic Test of Complete Assembly; and

b) Section 3.4, Hydrostatic Backpressure Test of Check Valves.

*~~**3.8.2.5**~~ **6.** Cold Water Test*

Flow water maintained at 40.0 +0/-7°F (4.4 +0/-3.9°C) through the assembly for ~~at least one (~~1~~)~~ hour. After one ~~(1)~~ hour, retest the assembly to Section 3.8.2~~.~~(3).

3.8.3 Criteria

Failure to meet the requirements of Sections 3.8.2~~.3~~(4) following both the hot water and cold water tests, and 3.8.2~~.4~~(5) following the ambient water test shall result in a rejection of the assembly.

3.9 Cycle Test

3.9.1 Purpose

The purpose of this test is to determine if the assembly sustains any damage, permanent deformation, or impairment of operation as a result of the cycling test.

3.9.2. Procedures ~~– Cycle Type DC Assemblies~~

Test ~~T~~the assembly ~~shall be tested~~ with ambient temperature water. Test the assembly in either its primary or alternate orientation. ~~During the cycle test, the~~ Partially open test cock #3 ~~test cock shall be open~~.

~~(a) Flow water through the assembly at 25% of rated flow at 60.0 psi ± 10.0 psi (413.7 kPa ± 68.9 kPa) for six (6) seconds minimum.~~

~~(b) Cease flow. Hold the assembly at a static pressure of 60.0 psi ± 10.0 psi (413.7 kPa ± 68.9 kPa) for five (5) seconds minimum.~~

~~(c) Decrease the supply pressure to atmospheric for three (3) seconds.~~

~~(d) Increase the backpressure to 150.0 psi (1034.2 kPa) or the manufacturer's maximum rated pressure, if higher, for six (6) seconds minimum.~~

~~(e) Remove the backpressure.~~

~~(f) Repeat (a) through (e) for 1,250 cycles.~~

~~(g) Test per Section 3.6, Drip Tightness of First Check, and 3.7, Drip Tightness of Second Check.~~

~~(h) Flow water through the assembly at 50% of rated flow.~~

~~(i) Repeat (b) through (e) for 1,250 cycles.~~

~~(j) Test per Section 3.6, Drip Tightness of First Check, and 3.7, Drip Tightness of Second Check.~~

~~(k) Apply a backpressure of 1.0 psi (6.9 kPa) for ten (10) minutes and observe for leakage from the #3 test cock.~~

~~(l) Apply a backpressure equal to the maximum rated working pressure of the assembly for ten (10) minutes and observe for leakage from the #3 test cock.~~

~~(m) Apply a backpressure of 1.0 psi (6.9 kPa) for ten (10) minutes at #3 test cock, reduce the supply pressure to atmospheric and observe for leakage from the #2 test cock.~~

~~(n) Raise the backpressure at #3 test cock to the manufacturer's maximum rated pressure, maintain for ten (10) minutes, and observe for leakage from the #2 test cock.~~

~~(o) Flow water through the assembly at 75% of rated flow.~~

~~(p) Repeat (b) through (e) for 1,250 cycles.~~

~~(q) Test per Section 3.6, Drip Tightness of First Check, and 3.7, Drip Tightness of Second Check.~~

~~(r) Flow water through the assembly at 100% of rated flow.~~

~~(s) Repeat (b) through (e) for 1,250 cycles.~~

~~(t) Test per Section 3.6, Drip Tightness of First Check, and 3.7, Drip Tightness of Second Check.~~

~~(u) Repeat (k) through (n).~~

1250 Cycles at 25% Flow

1. Flow water through the assembly at 25% of rated flow at 60 psi ± 10 psi (413.7 kPa ± 68.9 kPa) for a minimum of 6 seconds.
2. Cease flow; hold the assembly at a static pressure of 60 psi ± 10 psi (413.7 kPa ± 68.9 kPa) for a minimum 6 seconds.

3. Decrease the supply pressure to atmospheric for 3 seconds.
4. Increase the backpressure at test cock #4 to 175 psi (1206.6 kPa) or the manufacturer's maximum working pressure, if higher, for a minimum of 6 seconds.
5. Remove backpressure.
6. Repeat (1) through (5) for 1,250 cycles.
7. Test per Section 3.8.2(4).

1250 Cycles at 50% Flow
8. Repeat (1) through (5) for 1,250 cycles, but flow water through the assembly at 50% of rated flow.
9. Test per Section 3.8.2(4).

Second Check Valve Drip Evaluation
10. With test cock #3 open and apply a backpressure of 1 psi (6.9 kPa) at test cock #4 for 10 minutes and observe for dripping from test cock #3.
11. Apply a backpressure of 175 psi or the maximum working pressure of the assembly, whichever is greater for 10 minutes at test cock #4 and observe for dripping from the test cock #3.

First Check Drip Evaluation
12. With test cock #2 open and apply a backpressure of 1 psi (6.9 kPa) at test cock #3 for 10 minutes and observe for dripping from test cock #2.
13. Apply a backpressure of 175 psi or the manufactuer's maximum working pressure of the assembly, whichever is greater for 10 minutes at test cock #3 and observe for dripping from the test cock #2.
~~***3.9.3 Procedure - Cycle Type DCF Assemblies***~~
~~*The assembly shall be tested in either its primary or alternate orientation.*~~
~~*(a) Flow water through the assembly at 25% of rated flow at a minimum of 30.0 psi (206.8 kPa) for three (3) seconds minimum.*~~
~~*(b) Cease flow. Hold the assembly at a static pressure of 30.0 psi (206.8 kPa) for six (6) seconds minimum.*~~
~~*(c) While the assembly is at static, increase the back pressure to 175.0 psi (1206.6 kPa) or the manufacturer's maximum rated pressure, if higher, for six (6) seconds minimum.*~~
~~*(d) Increase the supply pressure to 175.0 psi (1206.6 kPa) or manufacturer's maximum rated pressure, if higher, and hold for six (6) seconds minimum.*~~
~~*(e) Fluctuate the supply pressure from 175.0 psi (1206.6 kPa) or manufacturer's maximum rated pressure, if higher, down to 10.0 psi (68.9 kPa). Repeat five-hundred (500) times.*~~
~~*(f) Repeat steps (a) through (e) ten (10) times.*~~
~~*(g) Test per Section 3.4, Hydrostatic Backpressure Test of Checks.*~~
~~3.9.4.~~ 3.9.3 Optional Method
The University of Southern California Foundation for Cross-Connection Control & Hydraulic Research (USC FCCC&HR) life cycle test protocol in the Manual of Cross Connection Control ~~Tenth Edition,~~ section 10.1.2.3.3.8 is acceptable provided the number of cycles and the flow rates are not less than those as specified in Section 3.9.2 ~~for DC assemblies or Section 3.9.3 for DCF assemblies~~.
3.9.4. Criteria
Failure to pass Section ~~3.6, Drip Tightness of First Check, and 3.7, Drip Tightness of Second Check,~~ 3.8.2 (4) at any point during the cycle test, ~~or leakage during backpressure in test steps (k) and (l),~~ shall result in a rejection of the assembly. Leakage during Section 3.9.2 (10) through (13) shall result in a rejection of the assembly.
~~***3.10 Body Strength Test for Type DCF Assemblies Only***~~
~~***3.10.1 Purpose***~~

~~*The purpose of this test is to determine if the assembly is capable of withstanding the pressures specified in Section 3.10.2 without leakage or damage to the assembly.*~~

~~*3.10.2 Procedure*~~

~~*Seal the inlet and the outlet of the assembly. Open the shut-off valves and purge the system of air. Pressurize the assembly with water to four (4) times the manufacturer's maximum rated pressure and hold for five (5) minutes.*~~

~~***3.10.3 Criteria***~~

~~*Any structural failure that causes leakage shall result in a rejection of the assembly. Leakage of seals or gaskets at flanges or threaded joints shall not be cause for rejection.*~~

~~***3.11 Seat Adhesion Test For DCF Assemblies Only***~~

~~***3.11.1 Purpose***~~

~~*The purpose of this test is to verify that after long term contact between a seat and a disc, adhesion has not occurred.*~~

~~*NOTE: This test may be performed on a different assembly from the assembly used for the previous performance tests.*~~

~~***3.11.2 Procedure***~~

~~*Test the assembly per UL Standard 312, Check Valves for Fire-Protection Service, Section 18, Adhesion Test for Resilient Material.*~~

~~***3.11.3 Criteria***~~

~~*Failure to meet any of the requirements of UL Standard 312, Check Valves for Fire-Protection Service, Section 18, Adhesion Test for Resilient Material, shall result in a rejection of the assembly.*~~

~~***3.12 High Velocity Test for Type DCF Assemblies***~~

~~***3.12.1 Purpose***~~

~~*The purpose of this test is to determine if the assembly can withstand ninety (90) minutes of water flow at 30.0 ft/sec (9.1 m/sec) without sustaining any permanent damage to internal components.*~~

~~*NOTE: This test may be performed on a different assembly from the assembly used for the previous performance tests.*~~

~~3.13~~ 3.10 Field Evaluation Test for Assemblies when Required by the Authority Having Jurisdiction

3. 1~~3~~0.1 Purpose

The purpose of this test is to ensure that after a one-year field evaluation, the assembly is capable of meeting the minimum performance requirements per the field test requirements in the ASSE Series 5000 Appendix E. It is the manufacturer's responsibility to notify the testing laboratory if a one-year field test is required.

3.1~~3~~0.2 Procedure

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NOTE: For the purpose of this test, the alternate orientation is defined as either ~~the~~ check ~~or the relief~~ valve being installed in a different position from the primary orientation.

Field installation sites shall be on different water distribution systems. Field locations ~~for type DC assemblies~~ shall provide a minimum of 2 flowing sites. ~~All field locations for type DCF assemblies shall be static (no flow). For type DCF assemblies only, the assembly shall be flowed at a rate of 10.00 GPM to 50.00 GPM (0.63 L/s to 3.15 L/s) for ten (10) minutes prior to each field test.~~

NOTE: The manufacturer is permitted to install a fourth assembly to be evaluated in the event one of the 3 primary assemblies fails for reasons other than manufacturing design.

Each assembly shall be field tested upon installation, at a minimum of once per quarter, and at the conclusion of the one-year field evaluation. One assembly shall be field tested on a monthly basis.

3.1~~3~~0.3 Criteria

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Section IV
4.1 Materials
…………………

~~4.2~~ 4.1.15 Grooved Connections
Inlet and outlet grooved connections shall comply with ANSI/AWWA C606~~, Grooved and Shouldered Joints~~.

~~4.3~~ 4.2 Marking Instructions
4. ~~3~~ 2.1 Marking of Assembly
Each assembly shall have the following information marked on it where it will be visible after the assembly has been installed:
a) Name of manufacturer or trademark;
b) ~~Type (DC or DCF) and~~ Model ~~number~~ designation *of the assembly;*
c) Maximum ~~rated~~ working pressure;
d) Maximum ~~rated~~ working temperature;
e) Serial number consistent with the manufacturer's standard practice.
f) Nominal valve size; and
g) The direction of water flow.
h) Each shut-off valve shall be marked with the manufacturer's name or trademark andmodel number.

~~For manifold assemblies, markings (a) through (g) are required for each individual assembly. Markings (a), (b), (e) and (f) are required on the manifold assembly.~~

4.2.2 Application of Markings
The markings shall be either cast, etched, stamped, or engraved on the body of the assembly or on a brass or stainless steel plate securely attached to the assembly with a corrosion resistant means.

4.~~4~~3 Installation and Maintenance Instructions
4.~~4~~3.1 Packaged Instructions
Complete instructions for installation and maintenance, including drawings or schematic sketches which may be useful to the installer, shall be packaged with each assembly.
4.~~4~~3.2 Orientation
The installation instructions shall indicate the tested and ~~approved~~ listed installation orientation of the assembly.
4.~~4~~3.3 Maintenance
All assemblies shall be capable of being maintained or repaired while in-line.
4.~~4~~3.4 Field Testing
Manufacturer's recommendations for field testing shall be furnished.
4.3.5 Readily Available Tools
Tools required to perform field service of the assembly shall be readily commercially available.

Section V

5.0 Definitions

Definitions not found in this section are located in the Plumbing Dictionary, ~~Sixth~~ 6th Edition, published by ASSE International.

Backflow Preventer Orientation

The direction of flow in a backflow prevention device or assembly identified as the direction of flow at the inlet and outlet of the device or assembly.

Horizontal Valve Orientation

The normal direction of flow in a backflow prevention device or assembly where the direction of flow from the inlet to the outlet of the device or assembly is a horizontal only direction.

N-Pattern Valve Orientation

The normal direction of flow in a backflow prevention device or assembly where the direction of flow rises vertically upward though the inlet shut-off valve of an assembly before flowing horizontally through the assembly body and then flowing in a vertical downward flow through the assembly outlet shut-off valve.

Resiliently Sealed

A sealing method, normally describing check valves, shut-off valves, or test cocks, where a seal is created by at least one surface temporarily changing its geometry under pressure to conform with another to seal and prevent fluid from passing. One example that may meet this is the use of an elastomer. One example that may not meet this is metal-to-metal seating.

Vertical Up Flow Valve Orientation

The normal direction of flow in a backflow prevention device or assembly where the direction of flow rises vertically from the inlet to the outlet of the device or assembly in an upward only direction.

Vertical Downflow Valve Orientation

The normal direction of flow in a backflow prevention device or assembly where the direction of flow falls vertically from the inlet to the outlet of the device or assembly in a downward only direction.

Z- Pattern Valve Orientation

The normal direction of flow in a backflow prevention device or assembly where the direction of flow rises vertically upward though the inlet shut-off valve of an assembly before flowing horizontally through the assembly body and then flowing in a vertical upward flow through the assembly outlet shut-off valve.

Appendix A — Installation Guidelines

A1.3 Side Clearances

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A1.3.2 *For assemblies sized 4 inch ~~– 10 inch~~ (100 mm ~~– 250 mm~~) and larger, each of the dimensions stated in Section A1.3.1 shall be increased 100%*

Table 1 was revised.
Table 2 was added.
Table 2 was revised and renumbered to Table 3.

Figure 1 was revised.
Figure 1A was revised and renumbered as Figure 2.