

Testing Procedures for Backflow Preventers

Prior to initiating a test of any backflow device, it is recommended that the following procedures be followed:

1. Permission be obtained from the owner, or his representative, to shut down the water supply. This is necessary to insure that since all testing is accomplished under no-flow conditions, the owner is aware that his water supply will be temporarily shut off while the testing is being performed. Some commercial and industrial operations require constant and uninterrupted water supplies for cooling, boiler feed, seal pump water, etc. and water service interruption cannot be tolerated. The water supply to hospitals and continuous process industries cannot be shut off without planned and coordinated shut downs. The request to shut down the water supply is therefore a necessary prerequisite to protect the customer as well as limit the liability of the tester.

Concurrent with the request for permission to shut off the water, it is advisable to point out to the owner, or his representative, that while the water is shut off during the test period, any inadvertent use of water within the building will reduce the water pressure to zero. Backsiphonage could result if unprotected cross-

connections existed which would contaminate the building water supply system. In order to address this situation, it is recommended that the owner caution the inhabitants of the building not to use the water until the backflow test is completed and the water pressure restored. Additional options available to the building owner would be the installation of two backflow devices in parallel that would enable a protected bypass flow around the device to be tested. Also, if all water outlets are protected within the building with "fixture outlet protection" backflow devices, cross-connections would not create a problem in the event of potential backsiphonage conditions occurring while devices are tested, or for any other reason.

2. Determine the type of device to be tested i.e., double check valve or reduced pressure principle device.

3. Determine the flow direction. (Reference directional flow arrows or wording provided by the manufacturer on the device.)

4. Number the test cocks, bleed them of potential debris, and assemble appropriate test cock adapters and bushings that may be required.

5. Shut off the downstream (number 2) shut-off valve. (Ref. Item (1) above.)

6. Wait several moments prior to hooking up the test kit hoses when testing a reduced pressure principle device. If water exits the relief valve, in all likelihood, the first check valve is fouled and it is impractical to proceed with the testing until the valve is serviced. This waiting period is not necessary when testing double check valves.

7. Hook up the test kit hoses in the manner appropriate to the device being tested and the specific test being performed.

Test personnel are cautioned to be aware and follow local municipal, county, and state testing requirements and guidelines as may be dictated by local authority. The following test procedures are guidelines for standard, generally acceptable test procedures but may be amended, superceded, or modified by local jurisdiction.

Test Equipment

For field testing of reduced pressure principle backflow preventers and double check valve assemblies, a differential pressure test gauge is utilized having a 0 to 15 psi range and a working pressure of 500 psi. Appropriate length of hoses with necessary fittings accompany the test gauge. Several manufactured test kits are commercially available that incorporate the differential gauge, hoses, and fittings and are packaged for ease of portability and come with protective enclosures or straps for hanging. Calibrated water columns are commercially available that are portable and come with carrying cases.

It is important that all test equipment be periodically checked for calibration.

Pressure Vacuum Breaker

(Figure 38)

Field testing of a pressure vacuum breaker involves testing both the internal spring loaded soft seated check valve as well as testing the spring loaded air inlet valve. The testing must be performed with the device pressurized and the air inlet closed. The number 2 shut-off valve must also be closed and the air inlet valve canopy removed.

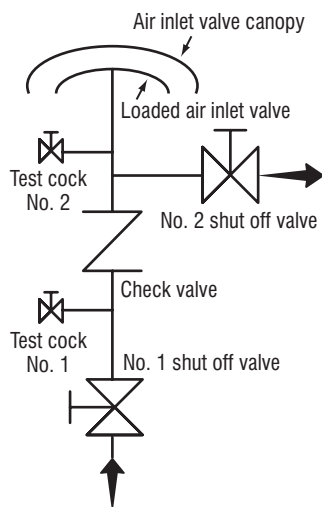
Method 1

Using a differential pressure gauge

Test 1 Test the internal check valve for tightness of 1 psid in the direction of flow.

1. With the valve body under pressure, (number 2 shut-off valve closed and

FIGURE 38.



- number 1 shut-off valve open) bleed test cocks number 1 and number 2.
2. Hook up the high pressure hose to number 1 test cock and the low pressure hose to number 2 test cock.
3. Bleed the high pressure hose, and low pressure hose, in that order, and close the test kit needle valves slowly.
4. Record the differential pressure on the gauge. A reading of 1 psid is acceptable to insure a tight check valve.

Test 2 Test the air inlet valve for a breakaway of 1 psi.

1. Connect the high pressure hose to test cock number 2, and bleed the high pressure hose.
2. Shut off number 1 shut-off valve.
3. Slowly open the bleed valve of the test kit, and observe and record the psi when the air inlet poppet opens. This should be a minimum of 1 psi. Restore the valve to normal service.

Method 2

Using a water column sight tube and 90 degree elbow fitting with bleed needle

Test 1 Test the internal check valve for tightness of 1 psid in the direction of flow.

1. Assemble sight tube to test cock number 1. Open test cock and fill the tube to a minimum of 36-inches of water height.
2. Close number 1 shut-off valve.
3. Open test cock number 2. The air inlet valve should open and discharge water through number 2 test cock.
4. Open number 1 test cock. The sight tube level of water should drop slowly until it stabilizes. This point should be a minimum of 28-inches of water column which equals 1 psi.

Test 2 Test the air inlet valve for a breakaway of 1 psi.

1. Assemble sight tube to test cock number 2. Open test cock number 2 and fill the tube to a minimum of 36-inches of water height.
2. Close number 1 shut-off valve.
3. Bleed water slowly from the number 2 test cock bleed needle and observe the water column height as it drops.
4. At the point when the air inlet valve pops open, record the height of the water column. This point should be a minimum of 28-inches of water column which equals 1psi.

Restore the valve to normal service.

Reduced Pressure Principle Backflow Preventer

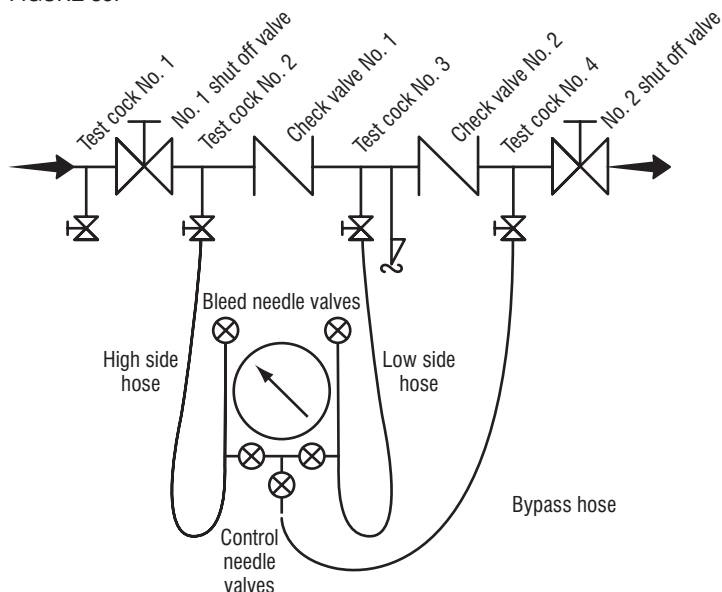
(Figure 39)

Field testing of a reduced pressure principle backflow preventer is accomplished utilizing a differential pressure gauge. The device is tested for three optional characteristics: i.e., (1) the first check valve is tight and maintains a minimum of 5 psi differential pressure, (2) the second check valve is tight against backpressure and (3) the relief valve opens at a minimum of 2 psi below inlet supply pressure. Testing is performed as follows:

Step 1 Test to insure that the first check valve is tight and maintains a minimum pressure of 5 psi differential pressure.

1. Verify that number 1 shut-off valve is open. Close number 2 shut-off valve. If there is no drainage from the relief valve it is assumed that the first check is tight.
2. Close all test kit valves.
3. Connect the high pressure hose to test cock number 2.
4. Connect the low pressure hose to test cock number 3.
5. Open test cocks number 2 and number 3.
6. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
7. Open the low side bleed needle valve on test kit bleeding air from the low hose. Close the low side bleed needle valve. Record the differential gauge pressure. It should be a minimum of 5 psid.

FIGURE 39.

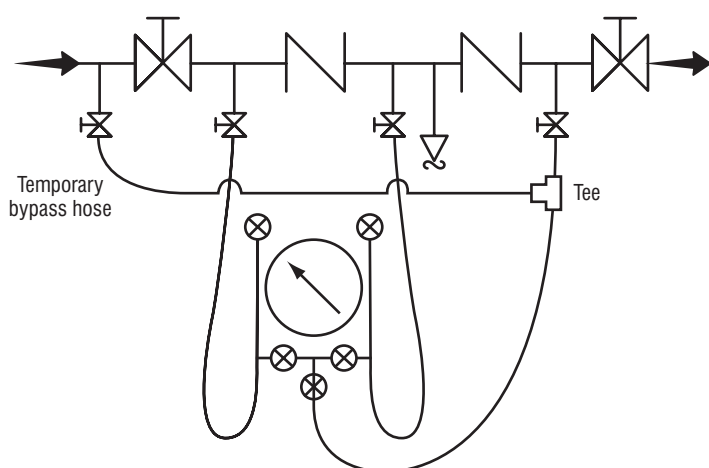


Step 2 Test to insure that the second check is tight against backpressure. (Figure 40)

1. Leaving the hoses hooked up as in the conclusion of Step 1 above, connect the bypass hose to test cock number 4.
2. Open test cock number 4, the high control needle valve and the bypass hose control needle valve on the test kit. (This supplies high

pressure water downstream of check valve number 2.) If the differential pressure gauge falls off and water comes out of the relief valve, the second check is recorded as leaking. If the differential pressure gauge remains steady, and no water comes out of the relief valve, the second check valve is considered tight

FIGURE 40.



3. To check the tightness of number 2 shut-off valve, leave the hoses hooked up the same as at the conclusion of Step 2 above, and then close test cock number 2. This stops the supply of any high pressure water downstream of check valve number 2. If the differential pressure gauge reading holds steady, the number 2 shut-off valve is recorded as being tight. If the differential pressure gauge drops to zero, the number 2 shut-off valve is recorded as leaking.

With a leaking number 2 shut-off valve, the device is, in most cases, in a flow condition and the previous readings taken are invalid. Unless a non-flow condition can be achieved, either through the operation of an additional shut-off downstream, or the use of a temporary compensating bypass hose, accurate test results will not be achieved.

Step 3 To check that the relief valve opens at a minimum pressure of 2 psi below inlet pressure.

1. With the hoses hooked up the same as at the conclusion of Step #2 (3) above, slowly open up the low control needle valve on the test kit and record the differential pressure gauge reading at the point when the water initially starts to drip from the relief valve opening. This pressure reading should not be below 2 psid.

This completes the standard field test for a reduced pressure principle backflow preventer. Before removal of the test equipment, the tester should insure that he opens number 2 shut-off valve thereby reestablishing flow. Also, the test kit should be thoroughly drained of all water to prevent freezing by opening all control needle valves and bleed needle valves.

All test data should be recorded on appropriate forms. (Ref: sample Page 45)

Note: The steps outlined above may vary in sequence depending upon local regulations and/or preferences.

Double Check Valve Assemblies

(Figure 41)

Some field test procedures for testing double check valve assemblies require that the number 1 shut-off valve be closed to accomplish the test. This procedure may introduce debris such as rust and tuberculin into the valve that will impact against check valve number 1 or number 2 and compromise the sealing quality. This potential problem should be considered prior to the selection of the appropriate test method.

Two test methods, one requiring closing of the number 1 shut-off valve, and one without this requirement are presented below:

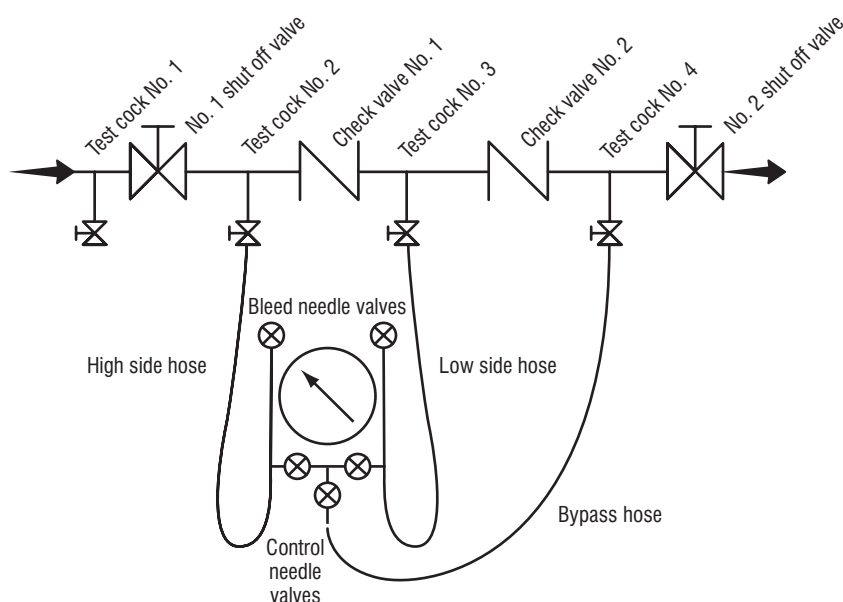
Method 1

Utilizing the differential pressure gauge and not shutting off number 1 shut-off valve. (Figure 41)

Step 1 checking check valve number 1

1. Verify that the number 1 shut-off is open. Shut off number 2 shut-off valve.
2. Connect the high hose to test cock number 2.
3. Connect the low hose to test cock number 3.
4. Open test cocks 2 and 3.
5. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
6. Open low side bleed needle valve on test kit bleeding the air from the low hose. Close the low side bleed needle valve.

FIGURE 41.



7. Record the differential gauge pressure reading. It should be a minimum of 1 psid.
8. Disconnect the hoses.

Step 2 Checking check valve number 2.

1. Connect the high hose to test cock number 3.
2. Connect the low hose to test cock number 4.
3. Open test cocks number 3 and 4.
4. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
5. Open low side bleed needle valve on test kit bleeding the air from the low hose. Close the low side bleed needle valve.
6. Record the differential gauge pressure reading. It should be a minimum of 1 psid.
7. Disconnect the hoses.

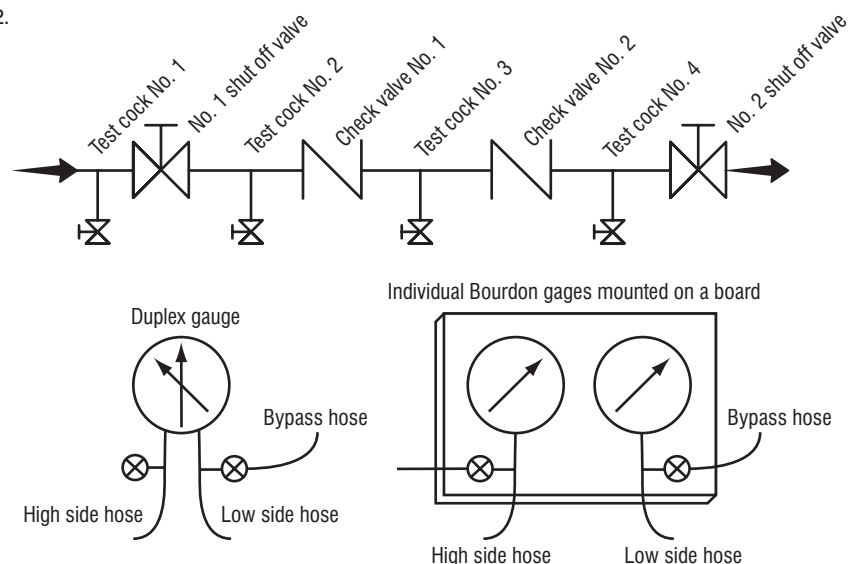
To check tightness of number 2 shut-off valve, both the check valves must be tight and holding a minimum of 1 psid. Also, little or no fluctuation of inlet supply pressure can be tolerated.

The testing is performed as follows:

1. Connect the high hose to number 2 test cock.
2. Connect the low hose to number 3 test cock.
3. Connect the bypass hose to number 4 test cock.
4. Open test cocks numbers 2, 3, and 4.
5. Open high side bleed needle valve on test kit bleeding the air from the high hose. Close the high side bleed needle valve.
6. Open low side bleed needle valve on test kit bleeding the air from the low hose. Close the low side bleed needle valve.

7. The differential gauge pressure should read a minimum of 1 psid.
8. Open the high side control needle valve and the bypass hose control needle valve on the test kit. (This supplies high pressure water downstream of check valve number 2).
9. Close test cock number 2. (This stops the supply of any high pressure water downstream of number 2 check valve). If the differential pressure gauge holds steady, the number 2 shut-off valve is recorded as being tight. If the differential pressure gauge drops to zero, the number 2 shut-off valve is recorded as leaking.

FIGURE 42.



With a leaking number 2 shut-off valve, the device is, in most cases, in a flow condition, and the previous test readings taken are invalid. Unless a non-flow condition can be achieved, either through the operation of an additional shut-off downstream, or the use of a temporary compensating bypass hose, accurate test results will not be achieved.

This completes the standard field test for a double check valve assembly. Prior to removal of the test equipment, the tester should insure that he opens number 2 shut-off valve thereby reestablishing flow. All test data should be recorded on appropriate forms and the test kit drained of water.

Method 2

Utilizing "Duplex Gauge" or individual bourdon gauges, requires closing number 1 shut-off. (Figure 42)

Step 1 checking check valve number 1

1. Connect the high hose to test cock number 2.
2. Connect the low hose to test cock number 3.
3. Open test cocks number 2 and number 3.
4. Close number 2 shut-off valve; then close number 1 shut-off valve.
5. By means of the high side needle valve, lower the pressure at test cock number 2 about 2 psi below the pressure at test cock number 3. If this small difference can be maintained, then check valve number 1 is reported as "tight". Proceed to Step number 2. If the small difference cannot be maintained, proceed to Step number 3.

Step 2 checking check valve number 2.

Proceed exactly the same test procedure as in Step number 1, except that the high hose is connected to test cock number 3 and the low hose connected to test cock number 4.

Step 3

1. Open shut-off valve number 1 to repressurize the assembly.
2. Loosely attach the bypass hose to test cock number 1, and bleed from the gauge through the bypass hose by opening the low side needle valve to eliminate trapped air. Close low side needle valve. Tighten bypass hose. Open test cock number 1.
3. Close number 1 shut-off valve.

4. By loosening the low side hose at test cock number 3, lower the pressure in the assembly about 10 psi below normal line conditions.
5. Simultaneously open both needle valves. If the check valve is holding tight the high pressure gauge will begin to drop while the low pressure gauge will increase. Close needle valves. If the gauge shows that a small (no more than 5 psi) backpressure is created and held, then the check valve is reported as tight. If the check valve leaks, a pressure differential is not maintained as both gauges tend to equalize or move back towards each other, then the check valve is reported as leaking. With both needle valves open enough to keep the needles on the gauge stationary, the amount of leakage is visible as the discharge from the upstream needle valve.