

General

This Guidance Document was written to provide assistance in design, installation and maintenance of backflow prevention assemblies. All backflow prevention assemblies must be installed and operated in accordance with [Part 18C of Title 15A of the North Carolina Administrative Code](#). If anything in this Guidance Document conflicts with Part 18C, Part 18C will take precedence.

No potable water supply shall be connected by any means whatsoever to another source of water supply or to a storage facility unless such connection has been previously approved by the Town of Mooresville Engineering Manager. No connection shall be made to any plumbing system that does not comply with the North Carolina State Building Code, volume II, or any applicable local plumbing code.

Facilities that Require Installation of a Backflow Preventer

The following locations require the use of a backflow prevention assembly (BPA). Reduced Pressure Principal Assemblies or air gaps are acceptable. Double Check Valve assemblies are not allowed. Note that this is not an exhaustive list and additional facilities may require backflow prevention based on the review by the Engineering Manager.

1. Fire sprinkler systems with or without booster pump facilities or chemical additives.
2. Connection to tanks, lines and vessels that handle non-toxic substances.
3. Lawn sprinkler systems with or without chemical injection or booster pumps.
4. Most commercial establishments.
5. Automatic service stations, bakeries and beauty shops with no health hazard and bottling plants with no back pressure.
6. Wastewater treatment plants
7. Connection to an unapproved water system or unapproved auxiliary water supply
8. Connection to tanks, pumps, lines, steam boilers or vessels that handle sewage, lethal substances, toxic or radioactive substances
9. Buildings with five or more stories above ground level
10. Hospitals and other medical facilities
11. Morgues, mortuaries and autopsy facilities
12. Metal plating facilities
13. Bottling plants (subject to back pressure)
14. Canneries
15. Battery manufacturers
16. Exterminators and lawn care companies
17. Chemical processing plants
18. Dairies
19. Film laboratories
20. Car wash facilities
21. Dye works
22. Laundries
23. Swimming pools
24. Water front facilities

Material Specifications

BPAs must meet the American Society of Sanitary Engineering (ASSE) standard and carry ASSE seal or be on the University of Southern California approval list, and must conform to AWWA C506, and adhere to ANSI and ASTM standards. All BPAs installed on fire lines shall be approved by Factory Mutual Systems (FM).

All internal parts must be replaceable in line.

All BPAs must have four (4) resilient seated test cocks, having ¼ turn ball valves with slotted or lever type operators. These test cocks shall be located in the following order:

1. 1st test cock: Before first shut-off valve.
2. 2nd test cock: Between first shut-off valve and first check valve.
3. 3rd test cock: Between the first and second check valve.
4. 4th test cock: Between the second check valve and the second shut-off valve.

BPAs smaller than 2" must have bronze or stainless steel bodies and bonnets and must be equipped with full port shut-off valves, of line size, having ¼ turn lever type bronze or steel ball valves.

All 3" to 10" BPAs shall have contained check valve modules. The bodies and bonnets must be made of one of the following: fusion bonded epoxy-coated cast iron, ductile iron or steel, or made of bronze or stainless steel. They must be equipped with manufactured approved resilient seated gate, wedge or ball valves with non-rising stems. The valves must have a manual hand wheel for operation.

Fire line services shall utilize a Reduced Pressure Principal Detector Assembly and tamper switch alarms on the main isolation valves. The BPA owner is responsible for any conduit and wiring necessary to operate the tamper switch alarms.

If a customer does not wish for water service to be interrupted when a BPA is tested, repaired or replaced, a parallel installation shall be made using an approved assembly. The parallel line may be of the same or smaller size.

Review and Approval

For new projects, BPAs must be shown and detailed on the design drawings to be approved by the Town prior to installation. Clearances around the assembly must be clearly marked, as must all drains. The drawings shall include a note stating "there shall be no taps, piping branches, unapproved bypass piping, hydrants, Fire Department connection points or other water-using appurtenances connected to the supply line between any water meter and its backflow preventer, as required by the Town of Mooresville."

For below-grade installations, calculations must be submitted demonstrating that the vault and drain pipe are adequately sized such that the BPA will not come into contact with any liquid under each of the following conditions:

1. Zero pressure on the inlet side (i.e., main break), resulting in full BPA operation.
2. Fully submerged drain outlet structure (including storm catch basins, ditches, ponds, etc).

Installation

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All BPA installations shall be per Town standards, and per the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research.

BPA's shall be installed:

1. On the outlet side of the meter service. If outside location is not possible due to required compliance with other applicable codes, ordinances or regulations, the Town may allow the assembly to be installed at a location approved by the Engineering Manager. The Engineering Manager reserves the right to require submission of supporting documentation and calculations including, but not limited to, those required for below grade installations.
2. By a licensed plumber or licensed utility contractor who holds a certificate of completion from an approved North Carolina Cross-Connection School in the testing and repair of backflow prevention assemblies.
3. Such that no portion of the assembly can become submerged in any substance under any circumstance.
4. With adequate clearance on all sides of the assembly per manufacturer's literature or other appropriate reference. Minimum clearances are as follows:
 - a. Twelve (12) inches from floor to lowest portion of device (with a maximum of thirty (30) inches).
 - b. One times the width of the device and its components clearance to any walls.
5. Horizontally.

For installations within a building:

1. 3/4" - 2" must have a minimum clearance of four (4) inches between the wall and shut off valves, a minimum of thirty (30) inches from the wall on the side utilizing the test cocks and a minimum of six (6) inches on the opposite side of the assembly. A minimum of four (4) inch floor drain shall be provided for the relief port.
2. 3" - 10" must have a minimum clearance of eight (8) inches between the wall and shut off valves, a minimum of thirty (30) inches clearance on the side utilizing the test cocks and a twelve (12) inch minimum clearance on the opposite side of the assembly. The floor drain shall be sized in accordance with the manufacturer's flow chart for relief valve.
3. A leak detection system complete with alarm shall be installed on the drain line to alert the BPA owner that a situation has caused the BPA to operate.

In the case of an air gap, the gap must be at least two times the inner diameter of the outlet pipe, with a minimum of 1".

Above-ground Installations

The Town requires that all above-ground BPA's be protected from freezing by installing a protective enclosure over the BPA. The Town does not require use of any of the prefabricated enclosures available on the market. All BPA enclosures must meet the following performance requirements:

1. Freeze Protection - enclosures must provide at least 6.5R factor insulation.
2. Insulation - attaching insulation to the BPA is not permitted.
3. Accessibility/Clearances – minimum side, end, and top clearances are as follows:
 - a. 3/4" - 1" shall have a clearance of four (4) inches from the end walls to ball valves, eight (8) inches clearance on the side utilizing the test cocks and four (4) inches on the opposite side.
 - b. 2" - 10" shall be installed in a sealed H-20 traffic rated vault. The 2" BPA shall have a clearance of four (4) inches from the end walls to ball valves, twelve (12) inches

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- minimum clearance on the test side of the assembly and eight (8) inches minimum clearance on the opposite side. The 3"- 10" BPA shall have a clearance of eight (8) inches from the end walls to the ball valves, thirty (30) inches clearance on the test side of the assembly and twelve (12) inches clearance on the opposite side.
4. The clearance requirements under Item 3 above may be waived IF:
 - a. adequate access to all parts of the BPA (including the shut-off valves) is readily provided
 - b. access provided allows testing and maintenance activity to be completed without having to enter the enclosure, and
 - c. The enclosure is lightweight (i.e. each section requires no more than 3 or 4 men to remove) and is fully removable intact or in panels.
 5. Drainage - adequate drainage for reduced pressure principle BPA's shall be provided via drain ports along the bottom of one of the side walls of the enclosure.

Above ground installations must be located outside of all required sight triangles, rights-of-way and easements. They shall not impair line of sight or legal movement for vehicular or pedestrian traffic. There may be other project-specific conditions that, in the opinion of the Engineering Manager, that warrant additional constraints on the location of the BPA.

A list of prefabricated fiberglass or aluminum BPA enclosures manufacturers follows:

1. BF Products
2. Hot Box enclosures by Northeast Florida Enterprises
3. Safe-T-Cover enclosures by Hydrocowl
4. Water Safe enclosures by G&C Enclosures

Below Grade Installations

Below grade installations of BPAs are not recommended. They are classified as Confined Spaces and are at increased risk of flooding due to clogged or undersized drains. Also, leaky or damaged assemblies are not as evident as they are in an above grade installation. BPAs may be installed below grade if the design engineer for the project can demonstrate that an above-grade installation is infeasible due to space availability or other constraints. Every attempt must be made by the design engineer to provide for above grade installation of BPAs. Approval of below grade installations will be at the discretion of the Engineering Manager.

All below grade installations shall be in a vault with a watertight hatch or door, and shall drain to grade or to a stormwater catchbasin. The drain pipe must be fitted with a vermin screen at each end.

The following clearances shall be maintained around the BPA within the vault:

1. 3/4" - 1" shall have a clearance of four (4) inches from the end walls to ball valves, eight (8) inches clearance on the side utilizing the test cocks and four (4) inches on the opposite side.
2. 2" - 10" shall be installed in a sealed H-20 traffic rated vault. The 2" BPA shall have a clearance of four (4) inches from the end walls to ball valves, twelve (12) inches minimum clearance on the test side of the assembly and eight (8) inches minimum clearance on the opposite side. The 3"- 10" BPA shall have a clearance of eight (8) inches from the end walls to the ball valves, thirty (30) inches clearance on the test side of the assembly and twelve (12) inches clearance on the opposite side.
3. A leak detection system complete with alarm shall be installed on the drain line to alert the BPA owner that a situation has caused the BPA to operate.

Indoor Installations

BPAs may be installed indoors only in the case of retrofits to existing buildings where outside above grade or below grade installation is not possible, or if outside installation is not possible due to required compliance with other applicable codes, ordinances or regulations. The design engineer must show that there are no other locations suitable for outdoor installation. Design requirements will be at a minimum, similar to the ones for below grade installation.

Testing Requirements

BPAs must be tested by a licensed plumber who has been certified by an approved school (as listed below) in the testing and repair of backflow prevention assemblies. All testers must adhere to test procedures for Reduced Pressure Principle Assemblies as listed in the current procedures from the University of Southern California Foundation for Cross-Connection and Hydraulic Research Manual of Cross-Connection Control.

A person wishing to be put on a list of approved testers for the Town of Mooresville must provide the Town of Mooresville Utilities Division with a letter of request with their full name, address, daytime phone number, the name of the school from which certification was obtained and the certificate number.

All BPAs must be tested and inspected at least annually. It is the responsibility of the BPA owner to secure a certified, Town-approved tester. Copies of the inspection report must be submitted to the Town of Mooresville Utilities Division (Attn: Backflow Prevention) and kept on file with the owner of the BPA for not less than five years.

If the annual test reveals that repair or replacement is necessary, the work shall be performed within ten days. A report of such maintenance shall be forwarded to the Town for its records.

In the event that a BPA installed inside a vault or building shows signs of having operated either through visual inspection or activation of the leak detection alarm system, the BPA shall be re-tested within ten days.

The following schools providing certification in Backflow Prevention Testing and Cross-Connection Control have been approved by the Town of Mooresville:

Fayetteville Public Works Commission
P. O. Box 1089
Fayetteville, NC 28302
Rob Allen, Coordinator
(910) 223-4699

City of Raleigh
Department of Public Utilities
P. O. Box 590
Raleigh, NC 27602
Ben Yarborough, Coordinator
(919) 831-6527

University of Southern California
Foundation for Cross-Connection Control and
Hydraulic Research School of Engineering
BHE 314 University Park MC-0231
Los Angeles, California 90089-2031
Paul H. Schwartz, P.E., Coordinator
(213) 743-2032

City of Durham
Department of Water Resources
101 City Hall Plaza
Durham, NC 27701
Steven Bledsoe, Cross Connection Control
Supervisor
(919) 560-4194

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Infotec, LLC
P. O. Box 1716
Carthage, NC 28327
Ronald West, Cross Connection
Training/Consultant
(910) 947-1115

University of Florida
Center for Training Research and Education for
Environmental Occupations (TREEO)
3900 SW 63rd Boulevard
Gainesville, FL 32608
(904) 392-9570

Charlotte-Mecklenburg Utility Department
System Protection Division Backflow Prevention
5100 Brookshire Blvd
Charlotte, NC 28216
Mark A. Krouse, Coordinator
(704) 399-2426 Ext. 294