New York State Department of Health

Guidelines for Designing Backflow Prevention Assembly Installations

Purpose

These guidelines reflect accepted design considerations based on experience in implementing cross connection control programs and policies set forth by the American Water Works Association, Environmental Protection Agency, USC Foundation for Cross Connection Control and Hydraulic Research and state and local health departments. Pending revisions to the manual, these guidelines should clearly outline what an acceptable design and installation constitutes.

General Installation Details

I. Clearances

All double check valve (DCV) and reduced pressure zone (RPZ) backflow prevention assemblies are designed for in-line service and must be installed to prevent freezing, flooding and mechanical damage with adequate space to facilitate maintenance and testing. Ideally, the installation should not require platforms, ladders or lifts for access. Adequate clearances from floors, ceilings and walls must be provided to access the test cocks and to allow the repair and/or removal of the relief valve and check valves; as follows:

- All assemblies shall be installed with a centerline height from 30 inches to 60 inches above the floor. Any installation at a greater height shall be provided with a fixed platform, a portable scaffold or a lift meeting OSHA standards.
- All RPZ devices must have an 18 inch minimum clearance between the bottom of the relief valve and the floor to prevent submersion and provide access for service and relief valve.
- A minimum of 12 inches of clear space shall be maintained above the assembly to allow for servicing check valves and for operation of shut-off valves.
- A minimum of 30 inches of clear space shall be maintained between the front side of the device and the nearest wall or obst ruction .
- At least 8 inches clearance should be maintained from the back side of the device to the nearest wall or obstruction. This clearance may need to be increased for models that have side mounted test cocks or relief valves that would be facing the back wall.

II. Miscellaneous Considerations

- All assemblies shall be adequately supported and/or restrained to prevent lateral movement. Pipe hangers, braces, saddles, stanch ions, piers, etc., should be used to support the device and should be placed in a manner that will not obstruct the function of or access to the relief valve.
  - Strainers are recommended prior to each backflow prevention assembly on non-firefighting water lines.
- The assembly should be sized hydraulically, taking into account both the volume requirements of the service and the head loss of the assembly. The head loss of the assembly is not necessarily directed proportional to flow. (Refer to the manufacturers' head loss curves).

- Before selection and installation, refer to manufacturer's literature for temperature ranges. All assemblies must be protected from freezing temperatures and if installed where temperatures will reach I 00 degrees For above, a hot water type assembly must be used. Consult manufacturers specifications for recommendations.
- Thermal water expansion and /or water hammer downstream of the assembly can cause excessive pressure. To avoid possible damage to the system and assembly, use water hammer arresters, surge protectors or expansion tanks as appropriate.
- All assemblies should be specified and installed with the manufacturer supplied resilient seated shut-off valves integral to the assembly.
- Water lines should be thoroughly flushed before installing the assembly. Most test failures on new installations arc the result of debris fouling one of the check valves or the relief valve.
- All assemblies must be installed horizontally unless they are specifically approved for vertical installation. (Ref. Technical Reference PWS-14).
- Parallel installations should be considered at those facilities where water service cannot be interrupted. Manifold installations may also be used on any water line larger than 10 inches.
- Assemblies shall not be installed in areas containing corrosive, toxic or poisonous fumes or gases which could render the assembly inoperable or pose a safety hazard to personnel.
- Because of the inherent design of a reduced pressure backflow assembly, fluctuating supply pressure on an extremely low flow or static flow condition may cause nuisance dripping and potential fouling of the assembly. While not effective in all cases, the installation of a soft seated check valve immediately ahead of the RPZ will often hold the pressure constant to the assembly in times of fluctuating supply pressure.
- Where the distance between the water meter and the device is greater than 10 feet, all exposed piping should be stenciled "Feed Linc to Backflow Preventer - DO NOT TAP" at 5 foot intervals.

Ill. **Drainage**

Drainage for backflow prevention assemblies shall be provided for **all** installations of DCV or RPZ to accommodate discharge during testing or draining of the unit and for RPZ relief valve discharges, as follows:

- For RPZ devices, drainage capacity shall be sized to accommodate both inte1mittent discharges **and** a catastrophic failure of the relief valve. Refer to manufacturers flow curves to determine maximum discharge rate based on supply pressure or on-site pressure; whichever is greater.
- Discharge from relief valves must be readily detectable to maintenance personnel either visually or by means of water level alarms, flow indicator lights, etc.
- All drainage from RPZ's must be by gravity drains. Sump pumps are not allowed unless they are sized to accommodate the maximum discharge rate **and** connected to emergency power supplies.
- An air gap must be maintained between the RPZ relief valve opening and any discharge piping. The air gap must be at least twice the dimension of the effective opening of the relief valve; but in no case less than 1inch.
- Manufacturer's air gap fittings may be utilized provided that they maintain a proper air gap and do not enclose or cover the relief valve. These fittings are only sized to handle intem1ittent and low flow discharges. Additional drainage capacity may be required to accommodate a catastrophic relief valve failure.
- Discharge piping from relief valves shall be terminated a minimum of one inch above any floor drain or other receiving receptacle.
- Discharge piping connected to a storm sewer shall be equipped with backwater check valve.
- Discharge piping connected to a sanitary sewer shall be trapped **and** equipped with a backwater check valve.
- Discharge piping from pits or other structures must be terminated above grade in an area not subject to flooding (generally one foot above the 100 year flood elevation). The terminal end of the discharge piping must have a rodent screen and may need to be supported by a headwall. Flap valves should also be considered to prevent entry of cold air.
- All exterior drains shall be kept free of snow during winter.

IV. Pit Installations

Primarily due to considerations for access, safety and gravity drainage, it is preferred that backflow prevention devices not be installed in pits. Where pit installations are proposed , however, they shall be designed:

- To be watertight with watertight manholes or access doors extending a minimum of 6 inches above grade and located to allow natural light into the pit during testing /maintenance.
- With stairways, ladders or step irons.
- For crane access for installing and removing large assemblies .
- With adequate horizontal and vertical clearances to allow access to the device .
- With a full flow screened gravity drain teerminating above grade for all RPZ installations as detailed in the drainage requirements.
- With sump pumps or gravity daylight drains for all DCVA installations.
- With floors pitched to drain.
- With adequate ground cover to prevent freezing.
- With surface grading to divert runoff away from the entrance way.
- Semi-buried pits for berm installations may be necessary to satisfy gravity drainage requirements.

V. Above Grade Installations- Protective Enclosures

An above grade installation is generally necessary to provide gravity drainage from RPZ devices. The additional benefits of improved access and enhanced safety are also realized with an above grade installation. Two companies, "Hot Box" and "Hydrocowl", have designed prefabricated insulated enclosures that provide heat, gravity drainage and removable access panels for servicing and testing. As an alternative, wood frame, fiberglass, steel, masonry or precast concrete structures may be utilized. All enclosures shall be designed:

- With a floor elevation that is at least 6 inches above finished grade.
- To provide adequate clearances around the device to access the test cocks, shutoff valves. check valves and relief valves.
- With electric heaters or heat trace wire for any water service used year-round.
- With provisions for natural or artificial light.
- With full flow gravity drains according to the drainage requirements.
- With security measures such as locking doors and panels, flow alarms or flow indictor lights, power indicator lights, etc.

VI. Installation Within a Building

Where containment at the property line cannot be achieved or is waived based on extenuating circumstances, installation within a building is often desirable as the unit can be installed in a mechanical room or other area that has heat and light. Access and drainage considerations must also be satisfied, and the devices should be located to avoid electrical panels, areas of excessive heat , etc.

1. Above grade installations shall be provided with adequate clearances and discharge can be directed to floor or drains or through a sidewall above grade via screened louvers, scuppers, pipe sleeves with nap valves, etc., in accordance with the drainage requirements.
2. Below grade or basement installations are acceptable for DCVA's. RPZ 's are only allowed below grade where one or more of the following conditions can be met:
    - Where an adequate gravity drainage system is provided to accommodate relief valve failure.
    - Where water level alarms are installed to detect flow from the device and alert maintenance or security personnel.
    - Where sump pumps are sized to accommodate a relief valve failure and are connected to emergency power.
    - Where the floor area and volume below the device could accommodate discharge from a

relief valve failure. For 2 inch and smaller units, 2,000 cubic feet is generally acceptable. For larger units, the time to submerge the device based on the maximum discharge rate and floor area/volume should be no less than 8 hours.

In any of the above cases, the property owner must be made aware of the potential for water damage in the event of a discharge.

VII. Submission and Approval of Plans

In accordance with Section 10 of the Cross Connection Control manual, the submission of plans and specifications for the installation of back flow prevention assemblies must include the following:

1. A **site plan** (to scale or with dimensions) of the facility containing a general location map , name and address of facility, property lines, buildings, the size and location of public water main(s) and all fire and domestic water services, meter pits, yard piping and hydrants , pumper connection(s), interconnections, and the location of the proposed backflow preventer(s).
2. A **plumbing floor plan** (plan view) or **partial floor plan** indicating water services, name and address of facility, water meter layout proposed backflow preventer(s), booster pump system, floor drain(s) and all nearby objects (examples: electrical panels, boilers, chillers, storage tanks, fire pumps. fire sprinkler risers, etc.). The plan must be drawn **to scale or with dimensions** indicated from walls and all nearby objects.
3. A **vertical cross section(s)** of the proposed installation with elevations from floor, ceiling, outside grade and all nearby objects.
4. All drawings must include the name and address of the facility, be stamped and signed by the designer and have a clear space for approval stamps.

VIII. Engineer's Report

An engineering report must be included with the plan submittal. The report must describe the project **in detail.** Hems that should be included or described in the report include:

1. General use of water within the facility.
2. Size and description of all fire and domestic water services.
3. Number of floors within the facility.
4. Actual or estimated maximum flow demand.
5. Pressures - existing and after the installation of the backflow preventer.
6. Description of the firefighting system - indicate the AW.W.A Manual M-14 class of sprinkler service.
7. Description of the proposed installation of the backflow preventer - indicates the location of backflow preventer, drainage, lighting, heating, access to unit, square footage of the floor level where the backflow preventer is to be located.
8. Description of the existing or proposed booster pump system, answering the following questions:
   A. After the installation of the proposed backflow preventer(s), will the Net Positive Suction Head (NPSH) required for the proper operation of the booster pump system be adequate?
   B. After the installation of the backflow preventer(s) in the suction line to the booster pump system, will the booster pump system operate properly at peak demand to deliver adequate pressure to the highest elevation and/or most remote fixt1.tre unit or any other operation requiring a certain pressure? Note: The New York State Uniform Fire Prevention and Building Code Part 902.4c requires the **minimum** pressure at water outlets at all times to be as follows:

      Fixture - non flush valve - 8 psi
      Fixture - flush valve - 15 psi

   C. Does the booster pump system have a pressure cutoff switch in the suction line? What is the pressure setting of the switch? An existing or proposed cutoff switch must be set at the following setting:

For a cutoff switch where the backflow preventer is located upstream of the booster pump(s) - set at 10 psi.

For a cutoff switch where the backflow preventer is located downstream of the booster pump(s) - set at 20 psi.

9. The need for dual backflow preventers. Does the facility need a continuous water supply?
10. The elevation and location of the 100-year flood plain in relation to the facility. A reduced pressure zone (RPZ) backflow preventer must generally be installed 1 foot above the 100 year flood plain elevation.
10. An inventory of any existing containment devices to include the make, model, size and serial number of the device. Current annual test reports must also be submitted. The degree of hazard for these services must be determined to ensure that the device provides the correct protection.

IX. Certified Testing and Completed Works Approval

After approval of plans has been issued and the assembly has been installed, it must be tested by a certified tester. The designer (or water supplier) is then responsible to certify that the installation was done in accordance with approved plans; or describe any changes or submit "As Built" plans as appropriate.

After issuance of the Completed Works Approval, the assembly must be tested at least annually by a certified tester with the results reported to the water supplier.