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Acronyms used in this chapter:

ANSI – American National Standards Institute
ASTM - American Society for Testing and Materials
AWWA - American Water Works Association
BMA - backflow/meter assembly
CCCP – Cross-Connection Control Program
CMR – Code of MA Regulations
DCVA – double check valve assembly
DWP – Drinking Water Program
FCC - Food Chemicals Codex
ISO - Insurance Services Organization
MA - meter assembly
MassDEP – MA Dept. of Environmental Protection

NFPA - National Fire Protection Association
NSF – National Sanitation Foundation
PE - polyethylene
PVC – polyvinyl chloride
PVCO - molecularly oriented polyvinyl chloride
PWS – public water system
RPBP- reduced pressure backflow preventer
UF - unidirectional flushing

Editor's Note: For questions on updates, please call the MassDEP Drinking Water Program in Boston, MA at 617-292- 5770, or e-mail the MassDEP Drinking Water Program Director at Program.Director-DWP@state.ma.us Attn: Guidelines.

CHAPTER 9
DISTRIBUTION SYSTEM PIPING AND APPURTENANCES

9.0 General

Water distribution systems shall be designed to maintain treated water quality. Special consideration should be given to distribution main sizing, providing for design of multidirectional flow, adequate valving for distribution system control, and provisions for adequate flushing. Systems should be designed to maximize turnover and to minimize residence times while delivering acceptable pressures and flows.

9.1 Public Water System Sizing

In determining if a water treatment, collection, storage or distribution system constitutes a public water system as defined by 310 CMR 22.00, the MassDEP shall use the higher value generated by multiplying the:

1. Number of service connections by 1.67 or number of service connections by the average household size in the community, which can be obtained from the U.S. Census site: http://factfinder.census.gov/home/saff/main.html or

2. Number of bedrooms by 2.0 (or 3.2 in areas of seasonal use)

In determining the average volume of water necessary to support a particular number of residents, the number of residents shall be multiplied by 100 gallons per day per capita. The average water volume accounts for water used for consumption, food preparation, laundering, bathing, and all other indoor sanitary uses with the exception of filling or maintaining indoor swimming pools.

9.2 Materials

1. Standards - Pipe, pipe coatings and linings, fittings, valves and fire hydrants shall conform to the latest standards issued by the American Society of Testing Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), Massachusetts Uniform State Plumbing Code 248 CMR 10.00, and National Sanitation Foundation International (NSF) if such standards exist. A spreadsheet list of all their current AWWA standards may

be found at their website http://apps.awwa.org/ebusmain/OnlineStore/ProductListing.aspx?Category=STAND

2. Used Materials - Water mains which have been used previously for conveying potable water may be reused provided they meet the above standards and have been thoroughly cleaned and restored practically to their original condition.

3. Joints

   a. Packing and jointing materials used in the joints of pipe shall meet the latest standards of the AWWA.

   b. Pipe having mechanical joints or slip-on joints with rubber gaskets is preferred.

   c. Gaskets containing lead shall not be used.

   d. Manufacturer approved transition joints shall be used between dissimilar piping materials.

4. Corrosion - Special attention shall be given to selecting pipe materials which will protect against both internal and external pipe corrosion, such as, poly encasement.

5. Permeation by organic compounds – The selection of materials is critical for water service and distribution piping in locations where there is likelihood the pipe will be exposed to significant concentrations of pollutants composed of low molecular weight petroleum products or organic solvents or their vapors. Research has documented that pipe materials, such as polyethylene, polybutylene, polyvinyl chloride, and asbestos–cement, and elastomers, such as used in jointing gaskets and packing glands, are subject to permeation by lower molecular weight organic solvents or petroleum products. If a water pipe must pass through a contaminated area or an area subject to contamination, consult with the manufacturer regarding permeation of pipe walls, jointing materials, etc., *before* selecting materials for use in that area.

6. Lead content – New products and components, including pipes, devices, media, and materials, shall demonstrate compliance with National Sanitation Foundation International (NSF) most recent standard NSF/ANSI 61 which now includes Annex G (weighted lead content of <=0.25%). For more information refer to the NSF website at: http://www.nsf.org/Certified/PwsComponents/ and Massachusetts Uniform State Plumbing Code 248 CMR 10.00.

7. Rehabilitation of water mains – All materials used for the rehabilitation of water mains shall meet latest ANSI/NSF Standards.

8. Temporary Piping- In the process of maintaining water mains, temporary piping is sometimes necessary. When used, temporary piping shall not be of materials that will compromise water quality. The public water system is responsible for the design and specifications of temporary piping that meets these minimum standards:

    a. The pipe materials shall conform to the same standards as permanent piping.

    b. The provision of temporary bypass piping must be made in a reliable and sanitary manner such that impurities are not imparted to the water.

    c. The pipe and/or hose must be designated or certified for potable/residential water use and must meet NSF Standard 61 certification and or AWWA standards.

    d. Disinfection of temporary pipes and hoses must be performed in accordance with AWWA standards.

    e. The recommended pipe materials are as follows:

        (1) Ductile iron pipe

        (2) Steel pipe

        (3) Plastic pipe:

            (a) Polyvinyl chloride (PVC) pressure pipe

            (b) Standard polyethylene (PE) pressure pipe and tubing, ½ inch (13 mm) through 3 inches (76 mm)

            (c) Standard polyethylene–aluminum–polyethylene & cross linked polyethylene–aluminum

            (d) Molecularly oriented polyvinyl chloride (PVCO) pressure pipe, 4 inches through 12 inches

            (e) Others as approved in writing by MassDEP

9.3 System Design

The normal working pressure in the distribution system should be approximately 60 – 80 psi and not less than 35 psi.

1. Pressure - All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on flow demands and pressure requirements. All service connections shall have a minimum residual water pressure at street level of at least 20 pounds per square inch under all design conditions of flow.

2. Diameter with fire protection - The minimum size of water main for providing fire protection and serving fire hydrants shall be 8-inch diameter. Larger size mains should be provided if necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure specified above. Any departure from minimum requirements shall be justified by hydraulic analysis and future water use, and can be considered only in special circumstances.

3. Diameter with no fire protection - The minimum size of water main in the distribution system where fire protection is not to be provided should be a minimum of three (3) inch diameter. Any departure from minimum requirements shall be justified by hydraulic analysis and future water use, and can be considered only in special circumstances.

4. Fire Protection - When fire protection is to be provided, the system should be designed so that fire flows and facilities meet the requirements of the National Fire Protection Association (NFPA), Insurance Services Office, Inc. (ISO) or other similar agency on fire flows required or recommended in the service area involved.

5. Hydrants - Water mains not designed to carry fire-flows shall not have fire hydrants connected to them.

6. Dead Ends - Dead ends shall be minimized by looping of all mains whenever practical. Dead ends shall be equipped with a means to provide adequate flushing which will give a velocity of at least 2.5 feet per second in the water main being flushed.

7. Flushing - Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure are sufficient or with an approved flushing hydrant or blow-off for flushing purposes. It is recommended that all water quality problem areas in the distribution systems be flushed at least twice each year. No flushing device shall be directly connected to any sewer.

8. Water Main Disinfection – New water mains and water mains that have been removed from service for repairs or maintenance or that continue to show the presence of coliform organisms shall be disinfected in accordance with latest AWWA standard C-651 *Disinfecting Water Mains*.

a. Used water appurtenances, such as, water meters shall be cleaned, disinfected, and then sampled for absence of coliforms before installation in accordance with latest AWWA standard C-651 *Disinfecting Water Mains*.

9. Annual Maintenance - MassDEP recommends annual system-wide flushing and a gate valve exercising program. Public or written notice to the affected water users should be given a minimum of 24 hours in advance to remind residents that they might have discolored water on the following day and advise them to flush their taps until the water runs clean during testing day.

    a. Unidirectional Flushing - Through unidirectional flushing (UF), naturally occurring sand, sediments, non-solidified deposits, loose corrosion by-products and other debris can be removed from a water supply system. This flushing is accomplished by opening each fire hydrant in the system under controlled conditions. This exercise flushes pockets of stagnated water out of the water supply system and improves the water quality not only in regard to color, odor and taste but also removes harmful constituents from the water supply. Unidirectional flushing is one of the most effective and economical solutions to clean the distribution system and to improve and maintain water quality. By closing the valves and creating a dead end in the opposite direction of main flow and opening the fire hydrants, a velocity of at least 2.5 ft/s is created that is required to remove sediments and contaminants.

       The implementation of UF requires planning in advance to identify valves to be closed, hydrants to be opened, and most important, the sequence of operation of the valves and hydrants. To maximize the velocity created when a hydrant is opened and minimize the chances of dirty water reaching a customer, each flushing step must be configured to ensure that water entering the main being flushed flows only from mains that have already been flushed clean. This type of flushing program usually should start upstream of the water supply system and proceed downstream in an outwardly direction. Organizing a flushing program for a smaller system that is branched like a tree can be relatively simple. However, systems with hydraulic models may use them to generate a flushing program.

10. Bleeders / blow-offs – All bleeders should be metered whenever possible. Meter readings should be taken monthly or as warranted to determine volumes of water that are run to waste.

9.4 Valves

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves should be located at not more than

500-foot intervals in commercial districts and at not more than one block or 800-foot intervals in other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing should not exceed one mile.

9.5 Hydrants

1. Location and Spacing - Hydrants should be provided at each street intersection and at intermediate points between intersections as recommended by the National Fire Protection Association (NFPA), Insurance Services Office, Inc. (ISO) or other similar agency on fire flows required or recommended in the service area involved. Generally, hydrant spacing may range from 350 to 600 feet depending on the area being served.

2. Valves and Nozzles - Fire hydrants should have a bottom valve size of at least five inches, one 4-1/2 inch pumper nozzle and two 2-1/2 inch nozzles.

3. Hydrant Leads - The hydrant lead shall be a minimum of 6 inches in diameter. Auxiliary valves shall be installed in all hydrant leads.

4. Drainage - When drains are plugged, the barrels should be pumped dry during freezing weather. Food Chemicals Codex (FCC) approved or food grade approved glycerine may be used as antifreeze. Where hydrant drains are not plugged, a gravel pocket or dry well shall be provided unless the natural soils will provide adequate drainage. Hydrant drains shall not be connected to or located within 10 feet of sanitary sewers or storm drains, and must be above the seasonal high groundwater table.

9.6 Air Relief or Air Release Valves Valve, Meter, and Blow-off Chambers

1. Use – Use of manual air relief valves is recommended wherever possible.

2. Air Relief or Air Release Valves - At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or air relief valves. Automatic air-relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

3. Air Relief Valve Piping - The open end of an air relief pipe from automatic valves shall be extended to at least 1 foot above grade and provided with a screened,

downward-facing elbow. The open end of an air relief valve pipe from a manually operated valve should be extended to the top of the pit and provided with a screened, downward facing elbow if drainage is provided for the manhole.

4. Chamber Drainage - Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or relief valves be connected directly to any sewer.

5. Air release valves shall meet latest edition of AWWA Standard C-512 Air-Release Air/Vacuum, & Combination Air Valves for Waterworks Service.

9.7 Installation of Water Mains

1. Standards - Specifications shall incorporate the provisions of the latest editions of AWWA standards and/or manufacturer's recommended installation procedures.

2. Bedding - A continuous and uniform bedding shall be provided in the trench for all buried pipe. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. Stones found in the trench shall be removed for a depth of at least 6 inches below the bottom of the pipe.

3. Cover - All water mains shall be covered with sufficient earth or other insulation to prevent freezing.

4. Backfill material - All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, frozen soil, or other unsuitable material.

5. Blocking - All tees, bends, plugs and hydrants shall be provided with reaction blocking, tie rods or joints designed to prevent movement.

6. Pressure and Leakage Testing - The installed pipe shall be pressure tested and leakage tested in accordance with the latest edition of appropriate AWWA Standards.

7. Disinfection - All new, cleaned or repaired water mains shall be disinfected in accordance with ANSI/AWWA Standard C651 Disinfecting Water Mains. The specifications shall include detailed procedures for the adequate flushing, disinfection, and microbiological testing of all water mains.

8. Chlorinated Discharge - In accordance with latest edition of AWWA Standard C-651 thorough consideration shall be given to the impact of discharge of highly chlorinated water to the environment. If there is any possibility that chlorinated discharge will cause damage to the environment, a neutralizing chemical, as listed in AWWA standard C-651, shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

9.8 Separation of Water Mains and Sewers

1. General - The following factors should be considered in providing adequate separation:

    a. Materials and type of joints for water and sewer pipes

    b. Soil conditions

    c. Service and branch connections into the water main and sewer line

    d. Compensating variations in the horizontal and vertical separations

    e. Space for repair and alterations of water and sewer pipes

    f. Off-setting of pipes around manholes

2. Parallel Installation - Water mains shall be laid at least 10 feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, it is permissible to install a water main closer to a sewer. However, the water main must be laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

3. Crossings - Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. It is preferred that the water main cross above the sewer. At crossing, one full length of water pipe shall be located so both joints will be as far from the sewer as possible, and the sewer materials shall be water works grade 150 psi pressure rated pipe meeting latest AWWA standards and shall be pressure tested to ensure water tightness. Special structural support for the water and sewer

pipes may be required, as well as special materials for construction and connecting devices.

4. Sewer Manholes - No water pipe shall pass through or come in contact with any part of a sewer manhole.

5. Zone 1 - Within the Zone I protective distance around gravel packed wells and tubular wells, all sewer lines and appurtenances are prohibited, unless they are necessary to eliminate existing and/or potential sources of pollution to the well. Refer to Review of Sewer Line/Water Supply Protection DWP Policy #: BRP/DWM/WS/P03-1 for more information including Zone 2 or IWPA (Interim Wellhead Protection Area) design requirements: http://www.mass.gov/dep/water/laws/wsp03-1.doc The above requirements are the same for bedrock wells, with MassDEP reserving the right to require more stringent controls as necessary to protect the public health.

9.9 Surface Water Crossings

Surface water crossings, whether over or under water, present special problems.

1. Above-Water Crossings - The pipe shall be adequately supported and anchored, protected from vandalism, damage and freezing, and accessible for repair or replacement.

2. Underwater Crossings - A minimum cover of five feet shall be provided over the pipe unless otherwise approved by MassDEP in writing. When crossing water courses which are greater than 15 feet in width, the following shall be provided:

    a. The pipe shall be special construction, having flexible, restrained or welded watertight joints.

    b. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding; the valve closest to the supply source shall be in a manhole.

    c. Permanent taps shall be made on each side of the valve within the manhole to allow insertion of a small meter gauge for testing to determine leakage and for sampling purposes.

9.10 Cross Connections

9.10.1 Cross Connection

Cross connection means any actual or potential physical connection or arrangement between a pipe conveying potable water from a public water system and any non-potable water supply, piping arrangement or equipment including, but not limited to, waste pipe, soil pipe, sewer, drain, and other unapproved sources.

9.10.2 Adoption of Local Controls

The successful promotion of a cross-connection control and backflow prevention program in a municipality will be dependent upon legal authority to conduct such a program. The Massachusetts Board of State Examiners of Plumbers and Gas Fitters Rules and Regulations Governing Plumbers and Gas Fitters 248 CMR 10.00: Uniform State Plumbing Code governs backflow and cross-connections. MassDEP recommends that a municipality adopt an ordinance that will establish a program for inspection and elimination of cross connections within the community. Frequently authority for such a program may already be possessed by the water department or water authority. In such cases no further document may be needed. A cross connection control ordinance should have at least three basic parts. [1]

1. Authority for establishment of a program

2. Technical provisions relating to eliminating backflow and cross connections

3. Penalty provisions for violations

The MassDEP Model Cross Connection Control Ordinance is suggested for municipalities who desire to adopt a cross-connection control ordinance. Communities adopting ordinances should refer to 310 CMR 22.22 to assure conformance with MassDEP regulations. The form of the ordinance should comply with local legal requirements and receive legal adoption from the community. The MassDEP Model Cross Connection Control Ordinance can be found at http://www.mass.gov/dep/water/drinking/systems.htm#crosscon

[1]Adapted from EPA Cross Connection Control Manual (2003)

9.10.3 Chemical Dispensers

Chemical dispensers are typically connected to potable water systems and therefore need backflow protection to prevent the concentrated cleaning chemicals from contaminating the water distribution system.

A PWS may allow the installation of chemical dispensers provided they have been approved by the Board of State Examiners of Plumbers and Gas Fitters and are installed with the following conditions:

1. Hard Piped

    a. The dispensers shall be installed by a Massachusetts licensed plumber.

    b. The installation of the dispenser shall be hard piped using Board of State Examiners of Plumbers and Gas Fitters product approved materials.

    c. Chemical dispensers equipped with an internal air gap or an alternative Certification of Listing under the ASSE 1055B Standard shall at a minimum have a dual check valve with an intermediate atmospheric vent installed at the incoming water supply line to the dispenser.

    Chemical dispensers not equipped with an internal air gap or an alternative Certification of Listing under the ASSE 1055B Standard shall have a reduced pressure backflow preventer (RPBP) installed at the incoming water supply line to the dispenser.

2. Hose Connection

    a. All dispensers shall have an air gap or, an alternative Certification of Listing under the ASSE 1055B Standard.

    b. Dispensers shall include a dual check valve with an atmospheric vent device installed at the water inlet as a secondary backflow protection.

    c. A stainless steel braided hose must be used.

    d. A pressure bleeder device shall be provided which will visually free flow water through the atmosphere from the faucet connection to a sink or drain. The purpose of the bleeder device is to indicate that the water is running and should be shut off to prevent hot water migration. The bleeder device shall connect to the water source utilizing a quick disconnect coupling.

    e. All external components will be permanently installed on the dispenser by the manufacturer and be ready for installation and use. External components include the dual check valve with atmospheric vent, stainless steel braided hose and the pressure bleeder device.

    f. Chemical dispensers not equipped with an internal air gap or an alternative Certification of Listing under the ASSE 1055B Standard shall have a reduced pressure backflow preventer (RPBP) installed at the incoming water supply line to the dispenser.

Note: Devices that attach to the faucet shall be arranged so it is one piece that will not allow the removal of the bleeder from the quick disconnect portion of this device. http://www.mass.gov Board of State Examiners of Plumbers and Gas Fitters Board Policies (PL) Regarding Chemical Cleaning Dispensers

9.10.4 Containment Policy

Numerous public water systems throughout Massachusetts have adopted locally mandated containment policies that require all service connections to have a backflow preventer installed at the meter regardless of the presence of an actual or potential cross connection.

As stated above, every public water system shall have a cross connection control program approved by MassDEP Drinking Water Program that includes, but is not limited to, a description of the current program and implementation plans. A locally mandated containment policy is considered by MassDEP to be part of a public water system's cross connection control program plan. Therefore, the following information pertaining to a locally adopted containment policy must be provided to MassDEP as part of a cross connection control program plan:

1. A copy of the public water system's containment policy

2. A description of the backflow preventer testing program in place for locally mandated containment devices which complies with the requirements of device testing per 310 CMR 22.22 (13)

3. A description of the strategy for re-inspection of non-residential facilities with locally mandated containment devices to ensure that the degree of hazard has not changed since the previous survey

Backflow preventers installed at the meter, as a result of a locally mandated containment policy and a survey that has determined that no hazard exists beyond the containment device, should not be included in the device inventory section of the DWP Public Water Supply Annual Statistical Report but must be maintained in an easily accessible format for emergency response purposes.

9.10.5 Cross-Connection Control Program Plan

To satisfy the requirements of MassDEP Drinking Water Regulations 310 CMR 22.22 (3) (b) every public water system shall have a cross-connection control program approved by MassDEP Drinking Water Program. A community public water system with a population greater than 3,300 must include a program description: staff profile, a strategy for testing, surveying, compliance and enforcement, fees structure, all forms required by the state, and a registration and tracking system. Small community public water systems, with a

population less than 3,300 people, must complete the questionnaire, *Cross-connection Control Program Plan for Small Community Public Water Systems.* Non-community public water systems must complete the *Cross-connection Program Plan Questionnaire for Non-community Public Water Systems.*

PWS must keep their program plans up to date and inform MassDEP of significant changes. In addition MassDEP may periodically request certification and/or re-submission of program plans to ascertain update status.

In order to aid water suppliers in successfully implementing a cross connection control program, a Cross Connection Control Program Manual has been developed, and can be found at http://www.mass.gov/dep/water/drinking/cccpman.doc

9.10.6 Cross-Connection Tester and Surveyor Certification

Any individual who passes a MassDEP approved written and practical examination for inspecting and testing backflow prevention devices and/or a MassDEP approved written examination for conducting cross connection surveys is eligible to apply for a MassDEP certification by submitting permit application BRP WS 10 - Certification or Certification Renewal as a Backflow Prevention Device Tester and/or Cross Connection Surveyor, which can be found at http://www.mass.gov/dep/water/ws10.doc

Obtaining a certificate from a MassDEP approved teaching institution for inspecting and testing backflow prevention devices and/or for conducting cross connection surveys does not constitute a MassDEP Certification.

For additional information on the MassDEP Cross Connection Certification refer to 310 CMR 22.22 at http://www.mass.gov/dep/water/ccdefreg.doc

9.10.7 Emergency Reporting

A Public Water System that has an incident of contamination of water in the distribution system from a backflow or cross connection incident must report the occurrence to MassDEP within 24 hours, as required by 310 CMR 22.15(9) (b) 2 and file an after action report within 30 days of the incident as required by 310 CMR 22.15(9) (c). For a complete copy of Emergency Requirement regulations refer to http://www.mass.gov/dep/service/regulations/310cmr22.pdf

9.10.8 Use of Fire Hydrants for Unauthorized Non-Firefighting Activities

Public water systems are vulnerable to contamination through the unauthorized use of fire hydrants from a variety of source such as, but not limited to, hydro seed companies, street sweepers, swimming pool fill trucks, etc. If, for example, the water pressure should fall

while a hydro seed tank truck is being filled, chemicals and seeds inside the tank could be sucked backwards through the hydrant and into the water supply. That could happen, for instance, if there was a break in a nearby water pipe.

Public water systems should establish a system for controlling the hook-up to a fire hydrant by persons other than a water department employee or a member of the fire department without a written permit from the public water system. The mechanism for controlling this use could include a:

1. Locally mandated regulation, ordinance or bylaw;

2. Permit with associated fee which would require an individual or company using water from a hydrant for purposes other than extinguishing fires to obtain a hydrant permit obtained from the public water system;

3. Damage deposit that should be refundable after payment of account in full and final inspection with no damage to backflow device, meter, piping, valves, box, or hydrant;

4. Hydrant meter and a wrench for the proper operation of the hydrant should be provided upon payment of a deposit in an amount established by the public water system. All authorized hydrant users should use an appropriate a backflow/meter assembly (BMA) unit or a meter assembly (MA) with an approved air gap. A rate structure could be established for the rental of the BMA unit or the MA unit;

5. Fine for using a fire hydrant without the appropriate permit and deposit.

9.10.9 Fire Protection – Substantially Modified System

Substantially modified means any change or modification to an existing fire protection system for which the cost of the backflow prevention device including installation is equal to or more than five percent of the cost of the fire protection system modification; or when the total cost of the fire protection system modification excluding the cost associated with the installation of a backflow prevention device equals or exceeds $100,000.00 as specified on the building permit application in accordance with 780 CMR 1.00.

MassDEP Drinking Water Regulations 310 CMR 22.22 (9)(d)1 requires that any new, existing or substantially modified fire protection system, including residential fire protection systems, be evaluated to determine if a cross connection exists. Additionally, 310 CMR 22.22 (9)(d)2 requires that all existing cross connections between public water systems and fire protection systems, as described in Table 22-1, 310 CMR 22.22(9)(a)19.a. and b. and installed prior to March 21, 1997, be equipped with a UL listed alarm check valve with the standard alarm pressure switch trim package.

In many cases existing fire protection systems must be modified to meet new occupancies, storage changes, increase in building size, or differing building uses such as:

1. Changing system types (e.g., wet to pre-action[2])

2. Adding a new system (e.g., pre-action[2], offices to a warehouse)

3. Increase in occupancy hazard classification (e.g., light hazard to ordinary hazard[3], ordinary hazard 1 to ordinary hazard 2, etc.)

It is the responsibility of the public water system to maintain a list of facilities that have fire protection systems that were installed prior to March 21, 1997 and that are equipped only with a UL listed alarm check valve with the standard alarm pressure switch trim package. Additionally, the public water system should maintain documentation that the alarm check valve complies with the applicable requirements stated in 310 CMR 22.22 (9) (d) 6.

[2]Pre-action systems as defined in 780 CMR: The Massachusetts State Building Code is a fire sprinkler system employing automatic sprinklers attached to a piping system containing air with a supplemental fire detection system installed in the same areas as the actuation of the fire detection system automatically opens a valve that permits water to flow into the sprinkler piping system and to be discharged from any open sprinklers.

[3]Hazard as defined by the National Fire Protection Association (NFPA)

9.10.10 Testing of Inaccessible Non-Residential Backflow Preventers

In the event that a non-residential facility known to have a backflow prevention device(s) is temporarily or permanently closed, the public water system can eliminate the testing of the device(s) if the hazard(s) has been removed or if the device has been removed so as to provide a physical separation between the potable and non-potable piping. If there is an existing fire protection system that continues to be operational and is equipped with a backflow prevention device the public water system must gain access to test that device. As per 310 CMR 22.22(4) (b) owners must have suitable arrangements made so that inspections of backflow prevention devices and cross connection surveys can be made during regular business hours. Refer to 310 CMR 22.22(2) (h) for a public water system authority to terminate a water service at http://www.mass.gov/dep/water/ccdefreg.doc

9.10.11 Lawn Irrigation

The installation of an approved backflow prevention device on lawn irrigation systems can prevent possible contamination of a public water system water supply with

contaminates such as lawn fertilizers, chemicals and pesticides. MassDEP Drinking Water Regulations 310 CMR 22.22(2) (a) states that no physical cross connection shall be maintained between the distribution system of a public water system, and the distribution system of any water source not approved by the Department; and that (b) backflow prevention devices shall be installed, based on the degree of hazard involved in accordance with 310 CMR 22.22 or Rules and Regulations Governing Plumbers and Gas Fitters, as applicable.

For residential lawn irrigation systems, MassDEP recommends that each public water system which has residential irrigation systems directly or indirectly connected to their public water system have a written residential lawn irrigation system cross connection control policy. This policy should be documented in writing and be approved by the governing body of the public water system. The policy should specify the minimum acceptable device for both high and low hazard residential lawn sprinkler systems. The written policy should, at a minimum:

1. Identify the type of backflow prevention device or assembly that is required to be installed on low hazard residential lawn irrigation system connections;

2. Establish a schedule for the required testing of testable backflow assemblies, if testable assemblies are designated by the policy as a minimum acceptable protection for low hazard residential lawn irrigation systems. The minimum testing frequency should be specified in the policy and appropriate records should be maintained to verify compliance with the established testing requirements.

3. Address high hazard residential lawn irrigation systems – any residential lawn irrigation system that includes chemical additions, or is also connected to another water source which is not an approved public water system, shall be considered a high hazard cross connection and should meet the requirements of 310 CMR 22.22 or Rules and Regulations Governing Plumbers and Gas Fitters, as applicable.

9.10.12 Preparing for a Cross Connection Control Program Audit

MassDEP will annually audit cross connection control programs to ensure that PWS are adhering to their approved program plans and provide maximum public health protection. At a minimum, the following information and documents will be reviewed at the time of a Cross Connection Control Program (CCCP) Audit:

1. Your system's MassDEP approved CCCP plan and respective letter of approval

2. Complete list of staff working on the CCCP and their respective cross-connection certifications

3. Samples of all the official correspondence for the CCCP, such as:

a. Forms

b. Letters

c. Violation notices

d. Enforcement letters

4. Backflow prevention device test results for the last seven years and the cross-connection survey reports of all commercial, industrial, institutional and municipally owned facilities

5. Other documents, such as:

    a. Residential educational/informational material

    b. Local ordinances/bylaws related to the CCCP

9.10.13 Record Keeping

A public water system must maintain a list of ALL cross connections that are being protected by a reduced pressure backflow preventer (RPBP) or a double check valve assembly (DCVA). The list must contain at a minimum the following information:

1. Owner and business name

2. Cross connection identification number

3. Type of protection (RPBP or DCVA)

4. Device manufacturer, model, and serial number

5. Exact location within the facility where device is located

A public water system must be able to provide to MassDEP within two hours the list of cross connections as described above. This list must be available in an electronic format.

9.10.14 Residential Sprinkler Systems

The Massachusetts Department Of Environmental Protection – Drinking Water Program, Massachusetts Fire Chiefs Association, Massachusetts Water Works Association, and New England Water Works Association have worked jointly in the development of Residential Sprinkler Systems this position statement. The organizations support and

encourage the installation of residential sprinkler systems because they will save lives, and can be utilized with acceptable impacts on public water supply at a reasonable cost.

The following procedures are acceptable for the installation of residential sprinkler systems:

1. First Choice Option: Flow through Connections.
   A single service connection to a house will supply the water for potable use and the residential sprinkler system. The split for the sprinkler will occur after the meter.
   The sprinkler system will be a flow through system that supplies a household item such as a toilet. The piping will be acceptable to the plumbing code for potable water and no backflow prevention device will be necessary.

2. Second Choice Option:
   A single service connection to a house will supply the water for potable use and the residential sprinkler system, the split for the sprinkler system will occur after the meter.
   These will be closed systems and will require a minimum of a residential dual check backflow preventers as long as no chemicals or anti-freeze is used. The dual check should be replaced at least during meter change out or as required by local authority or as conditions require.

Be Aware: If any chemicals or anti-freeze are used, a reduced pressure backflow prevention device (RPBP) must be installed.

A full text version of the Joint Position Statement on Backflow Protection for Residential Sprinkler Systems can be found on MassDEP's website at: http://www.mass.gov/dep/water/drinking/systems.htm#crosscon

9.11 Water Services and Plumbing

1. Water services and plumbing shall conform to the Uniform State Plumbing Code 248 CMR 10.00 which governs the requirements for the installation, alteration, removal, replacement, repair or construction of all plumbing in Massachusetts.

2. Unless otherwise required per 310 CMR 22.06 B (5), *Lead Service Line Replacement Requirements*, a water system shall replace annually at least seven percent of the initial number of lead service lines in its distribution system. The initial number of lead service lines is the number of lead lines in place at the time the replacement program begins. Refer to (5) *Lead Service Line Replacement Requirements* in MassDEP Regulations 310 CMR 22.06B *Control of Lead and Copper in Drinking Water* for more information. The lead action level is exceeded if the concentration of lead in more than 10% of tap water samples collected during any monitoring period conducted in accordance with 310 CMR

22.06B(7) is greater than 0.015 mg/L (i.e., if the "90th percentile" lead level is greater than 0.015 mg/L).

9.12 Service Meters

1. Each service connection should be individually metered to promote water conservation.

2. The master water meter at any building shall remain under the jurisdiction of the public water supplier.

3. MassDEP recommends submetering as a means to promote water conservation.

4. For more submetering information refer to the Department of Public Health State Sanitary Code 105 CMR 410.000 and 410.354 Metering of Electricity, Gas, and Water *http://www.mass.gov/Eeohhs2/docs/dph/regs/105cmr410.rtf*

9.13 Distribution System Pipe Repairs and Maintenance

Each PWS shall follow ANSI/AWWA G200-09 Standard for *Distribution Systems Operation and Management* during the repairs and maintenance of their water Distribution system.
http://www.awwa.org/Publications/StreamlinesArticle.cfm?ItemNumber=49465&showLog=N