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AQUA SM

**SPECIFICATIONS**

AQUA VIRGINIA, INC. PUBLIC WATER SYSTEMS

STANDARD SPECIFICATIONS FOR WATER MAIN EXTENSIONS, UPGRADES,

AND

DISINFECTION OF APPURTENANCES

ALL LOCALITIES, VIRGINIA

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COMMONWEALTH OF VIRGINIA
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*TABLE OF CONTENTS:*





## 1 INTRODUCTION

This standard specification outlines minimum standards for water main upgrades, line extensions, and new connections. It shall be given that all line replacements shall include abandonment of the old line where possible or as further directed by Aqua Virginia. It is also given that the intent of such projects is to improve the water works, improve system hydraulics, improve customer service, and eliminate re-occurring leaks on aging mains by their elimination from the system. Existing connections shall be re-connected to the new main after the new line has been constructed in accordance with these specifications. In certain cases, new service lines to existing meter boxes must also be installed and shall be determined on a project by project basis. New lines installed with this specification shall be installed parallel and adjacent to the existing line to be abandoned or a plan sheet prepared showing the new line's location. In any case, an updated plan sheet must be submitted to the VDH showing the location of the new main, diameter, and material and reference this standard specification. This standard specification may be referenced and submitted with a plan sheet to the Virginia Department of Health when:

- Lines are replaced with larger diameter mains and more than one connection is effected.
- New lines are installed or extended.
- As allowed by the Virginia Department of Health and the *Water Works Regulations*.
- When tanks or pump station appurtenances are replaced or pump house piping is replaced and must be disinfected in accordance with this standard during normal system maintenance (upgrade replacements).

New lines shall be equipped with appropriate blow offs at each end. For main extensions serving more than one connection or for emergency demand flows, these submissions may require a hydraulic calculation or model of the new line(s), and in some cases, the entire water works as determined by Aqua Virginia, Inc., and the Virginia Department of Health.

## 2 DISTRIBUTION SYSTEM PIPING

### 2.1 System Design

2.1.1 Dead-ends should be minimized by looping of mains.

2.1.2 Where dead-end lines occur, they shall be provided with a fire hydrant, flushing hydrant, or blow-off for flushing purposes.

2.1.3 No flushing device shall be directly connected to any sewer.

2.1.4 Sizing will be as shown on design drawings.

2.1.4.1 The minimum size pipe for water distribution systems shall be four inches in diameter. Pipes of lesser diameter may be used in the following instances:

2.1.4.1.1 When the run is less than 300 feet. two-inch pipe may be used.

2.1.4.1.2 When the run is less than 600 feet, but more than 300 feet, three-inch pipe may be used.



2.1.4.2 The minimum pipe size where fire protection is required shall be 6 inches in diameter.

2.1.5 System shall be designed such that a minimum of 20 PSI is maintained at all points on the system during peak flows (fire + domestic, commercial, industrial, etc.). Where the pressure at the service tap exceeds 80 PSI, the provisions of the Uniform Statewide Building Code shall apply.

2.1.6 All services shall be metered according to the standard meter detail (Drawing No.A0449).

### 2.2 Materials

2.2.1 Piping shall be AWWA C-900 PVC ring tite pipe, ASTM D2241 PVC, SDR-21, or HDPE pipe, unless another material is specified and approved by Aqua. All materials shall be NSF approved for potable water. Pipe fittings shall be slip-on PVC (ASTM D-2466) or mechanical joint ductile iron (ANSI/AWWA C-110). All joints shall be elastomeric gasket joints conforming to ASTM standard F-477. HDPE piping shall be installed in accordance with AWWA C-906-07. HDPE pipe shall be jointed by fusion butt welds. Fusion butt welds must be performed per the pipe manufacturer's recommendation. Sizing and material will be as shown on the drawing. Distribution line shall generally be pipe classes which exceed 160 PSI. *normally C-900 PVC. Pipe and* all water appurtenances shall bear the National Sanitation Foundation Seal of Approval (NSF) for potable water, the manufacture's name, and class of pipe.

2.2.2 Gate valves shall be iron body, bronze mounted, double disc parallel seat, non-rising stem gate valves conforming to AWWA C-500 or as shown on the drawings. Valves shall have mechanical joint ends conforming to AWWA C111 (ANSI A21.111). Valves shall be rated for a minimum working pressure as indicated by AWWA C-500. Valves shall open left (counterclockwise). (Kennedy 15TIX or equivalent). Valve boxes, should be cast iron adjustable screw type and level with pavement, or on shoulder, should extend 2" above ground with a 24"x24"x4" thick precast concrete pad installed around them and level with the box. In lieu of a concrete pad, a Brooks 24" valve box collar or other equivalent structure may be used.

### 2.3 Pipe Installation

2.3.1 All piping shall be installed according to the plans and applicable codes. PVC pipe installations shall conform to AWWA Section C-605 standard. HDPE pipe *shall be installed in accordance with* AWWA Section *C-906-07 standard.* Pipe bedding shall be per standard pipe bedding detail (Drawing No.A0444).



2.3.2 Pipe runs shall be true, direct, and consistent with space utilization.

2.3.3 Proper allowances shall be made for expansion, and all lines shall be adequately supported and anchored as necessary to prevent undue stress on pipes or equipment to which it may be attached.

2.3.4 Blocking shall be adequate to prevent noise or vibration when flows are turned on or off.

2.3.5 Bedding shall be Class "C-1" unless otherwise noted on the design drawings.

2.3.6 Stones and rocks found in the trench *shall be removed for a depth of* at least six inches below the bottom of the pipe and select fill bedding provided if necessary. Continuous and uniform bedding is required for all pipe.

2.3.7 The minimum depth of installation shall be 36 inches.

2.3.8 A means of locating the conduit while it is underground shall be provided. A locating wire, #16 THHN or larger, shall be run with the pipe, the ends terminating at the ground surface at the top of the valve box, meter, hydrant, flush off, or other surfacing structure as appropriate.

2.3.9 Any exposed piping will be insulated to prevent freezing.

### 2.4 Mechanical Restrained Joints and Blocking

2.4.1 Mechanical joint type restraints must be installed in accordance with the manufacturer's recommendations.

2.4.2 Blocking may be installed according to the standard detail sheet (Drawing No.A0439) for thrust blocking if approved by Aqua Virginia. Note that fittings smaller than 8 inch shall use minimum 3/4 CY of concrete for blocking. Ten to twelve inch fitting shall have 1.5 CY concrete. Sixteen to 24" shall have 2 CY concrete. Mechanical type joint restraints should be used over concrete.

### 2.5 Separation of Water and Sewer Lines

Follow Virginia Department of Health Waterworks Regulations for separation of water mains and sewer lines.

#### 2.5.1 Parallel Installations

Normal Conditions - Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.



Unusual Conditions - When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sewer manhole provided that:

2.5.1.1 The bottom (invert) of the water line is at least 18 inches above the top (crown) of the sewer.

2.5.1.2 Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 50 PSI without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.

#### 2.5.2 Crossing Installations

Normal Conditions - Water lines crossing over sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.

Unusual Conditions - When local conditions prevent a normal vertical separation described above, then the following construction shall be used:

2.5.2.1 In closer than normal conditions, the sewer pipe shall be AWWA approved water pipe pressure-tested in place to 50 PSI without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.

2.5.2.2 Water lines passing under sewers shall, in addition, be protected by providing:

2.5.2.2.1 A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water lines,

2.5.2.2.2 Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.

2.5.2.2.3 That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

2.5.2.3 Sanitary and/or Combined Sewers or Sewer Manholes - No water pipes shall pass through or come in contact with any part of sewer or sewer manhole.

### 2.6 Air Release Valves

2.6.1 Air release valves shall be compound lever type which conforms to ANSI/AWWA C512-92.

2.6.2 Valves shall be sized in accordance with the following table:

| Pipe Size | Orifice Size |
|---|---|
| 6" or Below | 1/16" |
| 8" - 10" | 3/32" |
| 12" - 16" | 1/8" |
| 16" - 48" | 3/16" |



2.6.3 Valves shall be Val-Matic Valve and Manufacturing Corp. valves or an approved equal.

2.6.4 Valves shall be provided with a downward facing, screened air release pipe extending a minimum of 12 inches above grade. However, a manual air release valve may be substituted in certain cases where they may be necessary. The manual air releases should have the vent extending to the top of the box with threaded end and a cap.

### 2.7 Valve, Air Relief, Meter, and Blowoff Chambers

2.7.1 Chambers shall be drained to the surface of the ground or to absorption pits located above the seasonal ground water table elevation.

2.7.2 Chambers or pits containing valves, blowoffs, meters, or other such appurtenances shall not be connected directly to any storm drain or sanitary sewer, nor shall blowoffs or air relief valves be connected directly to any sewer.

### 2.8 *Stream Crossings*

2.8.1 Crossings below the bottom of the stream bed shall be constructed in accordance with these specifications and plan details.

2.8.2 Crossings above the water (aerial) or in the water (submerged) shall be designed on a case-by-case basis, with provisions for adequate pipe support, freeze protection, and accessibility for repair/replacement, and above 100 year flood level. Where practical, the main may be designed on a bridge with VDOT approval. Where practical, the main may be directionally drilled with HDPE pipe under the obstruction.

2.8.3 Casings for crossings shall be Schedule 40 steel pipe.

2.8.4 Valves shall be installed on each end of crossings and dams so that the sections can be isolated for tests or repairs. Sample taps will be located on each end of the crossing for pressure testing and be constructed such that they will not be subject to flooding.

2.8.5 A permanent tap shall be made for testing of the isolated section for leaks.

2.8.6 *Piping* for crossings shall be of special construction, having flexible watertight joints, as shown on the plans.



### 2.9 New Hydrants

2.9.1 Where hydrant drains are not plugged, they shall be drained to the ground surface or to dry wells provided exclusively for this purpose. When installed in areas subject to high groundwater, flooding, surface water ponding, or spills, hydrants shall be plugged or hard-piped to drain to grade.

2.9.2 Hydrant drains shall not be connected to sanitary sewers or storm drains.

2.9.3 Hydrant shall be connected only to 6" mains and larger with a valve.

2.9.4 Hydrant shall only be connected to water systems adequately designed for fire flows in addition to domestic flow.

## 3 CONCRETE

3.1 Portland cement shall conform to ASTM Specification C150, Type I and II.

3.2 All course and fine aggregate shall conform to ASTM Specification C33.

3.3 Concrete pads, such as door steps and well head aprons, shall be poured with a mix which provides a compressive strength of 2000 PSI.

3.4 Concrete for thrust blocks (if approved for use) as shown in Drawing No.A0439 shall provide a compressive strength of 3000 PSI and meet detail requirements as shown Drawing No.A0455.

## 4 PRESSURE TESTING

4.1 Upon completion of the installation of all items, the water distribution system shall be leakage tested in accordance with AWWA Standard C-605 by running pump pressures above normal operating pressure. manipulating valves and observing gauges and exposed joints for any apparent leakage; and pressure tested at 150 PSI for two hours.

4.2 A leakage test shall be conducted concurrently with the pressure test in accordance with AWWA C-600, except as modified herein. LenKage is defined as the quantity of water required to maintain a pressure within 5 PSI of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed 3.25 GPD/mi/in. of nominal diameter at a pressure of 150 PSI. If leakage exceeds that specified, find and repair the leaks and repeat the test until successful. All visible leaks shall be repaired regardless of the amount of leakage.



## 5 STANDARD DISINFECTION METHODS FOR TANKS AND PIPING

Upon completion of construction, all pumps, tanks, and piping will be cleaned or flushed as necessary and then disinfected as follows:

### 5.1 Pressure Tanks

Potable water containing a free chlorine residual of 50 mg/l. shall be placed in the tank to such a depth that when the tank is filled, the resulting chlorine concentration in the water will be at least 2 mg/l. after 24 hours. The water containing 50 mg/L of chlorine shall stand in the tank for 24 hours. The tank shall then be filled with potable water to overflow and allowed to stand for 24 additional hours. At the end of the second 24 hour period, the chlorine residual shall be at least 2 mg/L. After analyzes of the water for satisfactory bacteriological quality, the tank may be placed in service without draining the water to disinfect it. Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no contamination before the tank can be utilized as part of the waterworks. If contamination is indicated, the procedure will be repeated.

### 5.2 Atmospheric Storage Tanks

All interior surfaces of the tank shall have applied a chlorine solution containing at least 200 mg/l of free available chlorine. The chlorine solution shall be applied with either spray equipment or brushes. Any equipment used to apply the chlorine solution shall either be new or previously used only for disinfection purposes. The chlorine solution shall remain in contact with the tank surfaces for at least 30 minutes. The tank shall then be filled with potable water to the overflow level and two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no contamination before the tank can be utilized as part of the waterworks. If contamination is indicated, the procedure will be repeated.

### 5.3 Pumps and Pump House Piping

5.3.1 The pumps and piping shall be filled slowly with potable water to which enough chlorine has been added to produce a free residual of 100 ppm. After the pumps and piping have been filled, they shall stand full for 6 hours. After the holding period, the chlorinated water in the pumps and piping shall be pumped off to waste by the pump and the piping shall be refilled. After refilling the piping, samples of water shall be takes from the station at not less than 24 hour intervals for bacteriological analysis by a certified laboratory until two (2) or more consecutive satisfactory samples are obtained.

5.3.2 Pump house piping shall be disinfected *in accordance with distribution system* piping and shall not be placed in service until disinfected.



### 5.4 Distribution System Piping

#### 5.4.1 System Flushing

Prior to disinfection all water lines shall be flushed unless the tablet method disinfection is used. All valves and hydrants shall be operated while chlorinated water is in the pipe. After the required retention period. the chlorinated water shall be flushed from the pipelines using potable water.

#### 5.4.2 Chlorine Application

##### 5.4.2.1 Continuous Feed Method

Potable water shall be introduced into the pipeline at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/l. The chlorinated water shall remain in the pipeline at least 24 hours, after which. the chlorine concentration in the water shall be at least 10 mg/l.

##### 5.4.2.2 Slug Method

Potable water shall be introduced into the pipeline at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/l in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 mg/l chlorine solution for at least 3 hours. The chlorine residual shall be checked at regular intervals not to exceed 2000 feet to insure that adequate disinfection is occurring.

##### 5.4.2.3 Tablet Method

This method shall not be used if nonpotable water or foreign materials have entered the lines or if the water temperature is below 5° C (41°F). The tablets shall be placed in each pipe section and in all appurtenances. Enough tablets shall be used to insure that a chlorine concentration of 25 mg/l is provided in the water. They shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be acceptable to the State Health Department. The filling velocity of the potable water in the pipeline shall be less than 1 ft./sec. The water chlorine solution shall remain in contact with the pipe for 24 hours.

#### 5.4.3 Bacteriological Sampling



After the lines have been flushed, two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no contamination before the pipe can be utilized as part of the waterworks. If contamination is indicated, then the disinfection and the bacteriological sampling procedure must be repeated. Samples should be marked "Construction Samples" to prevent confusion with regular distribution samples. Samples shall be collected at regular intervals, not exceeding 1200 feet throughout the length of the pipeline. Disinfect and test water mains and accessories in accordance with the procedures outlined in AWWA Standard C-651. All lines shall be disinfected prior to being placed in operation. Interior pump house piping connected hydraulically to new distribution system piping will be disinfected simultaneously with that piping as outlined herein.

### 5.5 Repairs

Cleaning, disinfecting, flushing, testing, or similar operational actions shall be in accordance with the current standard issued by AWWA (AWWA C-601).

## 6 QUALITY OF WORK

All materials and workmanship included in this project shall be first class as judged by the standards of the trades involved.

Contractor shall contact Aqua Virginia, Inc. prior to the filling of mains and flushing, and as needed so as to prevent unauthorized service interruptions to other customers.

## 7 LISTING OF STANDARD DETAILS

| DRAWING NO. | TITLE |
|---|---|
| A0444 | Standard Pipe Bedding |
| A0449 | Standard Meter Box |
| A0439 | Typical Thrust Block Detail |
| A0455 | Standard Thrust Blocking Details |
| A0441 | Standard Valve Construction |
| A0477 | Standard Blow-Off |
| A0448 | Manual Air Release Valve |
| A0440 | Standard Fire Hydrant |


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# WATER SPECIFICATIONS

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PREPARED FOR
HUNGATE-FIELDS, LLC

VALLEY MAGISTERIAL DISTRICT
THE COUNTY OF BOTETOURT, VIRGINIA

| REVISIONS | | |
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DATE: July 25, 2017
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