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SECTION 15 12 16

PRESSURE TESTING AND DISINFECTION OF WATER MAINS

PART 1.00 - GENERAL

1.01 Description

The work covered in this Section includes requirements for properly disinfecting and hydrostatically testing all new water mains or appurtenances put into use.

1.02 Quality Assurance

- A. Disinfection shall be performed in accordance with rules and regulations of the Public Water Supply Branch of the North Carolina Department of Environment, Health and Natural Resources, Division of Environmental Health.
- B. Perform pressure testing prior to the disinfection of the water mains unless otherwise directed by the Engineer.

PART 2.00 - PRODUCTS

2.01 Hydrostatic Testing Materials

The contractor shall provide all materials, labor, equipment, tools etc to perform all work and services necessary for and incidental to a complete pressure of the Water Distribution System in accordance with the Contract Documents and AWWA C600.

A. Pressure Gauge

1. Pressure gauge shall have a three inch (3") minimum diameter face, two hundred (200) psi minimum operating pressure, and maximum dial gradation increments of one (1) psi.

B. By-pass Pump

1. By-pass pump with motor, pressure-relief valve, shut-off valve and hoses rated for a minimum of 150% of required actual test pressure.

2.02 Disinfection Materials

The contractor shall provide all materials, labor, equipment, tools etc to perform all work and services necessary for and incidental to a complete disinfection of the Water Distribution System in accordance with the Contract Documents and State Requirements.

C. Water Required

1. The water required for filling, flushing, disinfecting and sampling shall be furnished by the City at such times, or times when the quantity is available. The Contractor is to notify the City no less than 48 hours prior to filling, flushing, disinfecting or sampling.

D. Disinfecting Agent

1. The disinfecting agent shall be an approved dry chemical compound such as high Test Hyperchlorite (HTH), and such disinfecting agent shall be provided by the

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Contractor.

PART 3.00 - EXECUTION

3.01 Pressure Testing

A. General

1. All testing shall be witnessed by the Engineer or his appointed representative
2. Prior to pressurization of lines, all trenches shall be backfilled to ground surface and all blocking shall have had sufficient curing time to achieve a minimum compressive strength of Twenty-Five Hundred (2500) psi
3. Prior to pressurizing the system for tests, air shall be vented from the system at high points using services, hydrants, or taps specifically installed for air release. No additional payment shall be made for taps made specifically for air release or pressure testing.
4. Pressure and leakage test shall be run for a minimum of two (2) hours measured from the time that the pump is turned off. Test may be run concurrently.
5. Minimum test pressure shall be One Hundred and Fifty (150) psi measured at the lowest elevation in the test section. Dedicated firemains to buildings shall be tested at Two Hundred (200) psi.
6. Maximum length of main(s) to be included in a single test shall be Five Thousand (5000) feet.
7. Pressure test shall be complete before any service taps are made unless otherwise authorized by the Engineer.

B. Allowable Leakage

Allowable leakage shall be calculated in accordance with AWWA C600; an excerpt has been included below

1. Allowable Leakage Formula

$$L = \frac{S * D * (P)^{1/2}}{133,200}$$

Where:

- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the leakage test, in pounds per square inch (gauge)

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2. Excerpt of Allowable Leakage Table

Avg. Test Pressure (psi)	ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE											
	Nominal Pipe Diameter in Inches											
	3	4	6	8	10	12	14	16	18	20	24	30
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52

3. If the main(s) being tested contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size using the above Formula or Table.

C. Line Acceptance

1. Line acceptance shall be based upon Allowable Leakage being greater than or equal to the actual leakage measured during the Leakage Test.
2. Leakage during test shall be measured using either an approved flow recording meter or direct measurement in a clean cylindrical container of known volume.
3. Leakage amount shall be the actual volume of water required to pump the test section back to the initial test pressure at the start of the test.

D. Correction and Retesting

1. Any sections of watermain, services, fittings, valves or appurtenances that do not pass the minimum test requirements shall be replaced and/or corrected prior to the retesting as approved by the Engineer.
2. No additional compensation shall be paid to the Contractor for correcting and retesting.

3.02 Disinfection

A. General

1. Bacteriological testing services on the water distribution system will be provided by the City.
2. The Contractor shall be responsible for the coordination of sampling and testing. The Contractor shall be responsible for providing tools and manpower necessary for filling, flushing, sampling, etc.
3. All additions to or replacements of the water distribution system including fire lines shall be disinfected. Such additions and or replacements to the water

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distribution system so disinfected shall receive a negative bacteriological test result prior to being placed in service.

4. The Engineer or his appointed representative shall be present during the chlorination process and during sampling. A scheduling notice of at least forty-eight (48) hours shall be given to the City of Rocky Mount Water Plant personnel prior to the Contractor performing any of the chlorination process.
 5. Any additional service taps necessary for: (1) a water source from existing system; (2) injection of chlorine solution; (3) flushing; and (4) sampling, shall be made directly to the water main and in accordance with Section 15 12 13 for 3/4" or 1" service tap with the exception that no meter box or meter will be required. Service taps for injection of chlorine solution and sampling shall be installed during pipe installation at intervals of 1,000 feet. No payments shall be made for additional taps necessary for filling, flushing, testing, or disinfecting. The Contractor may use water services scheduled for existing lots of record as shown on the Drawings or directed by the Engineer.
- B. Disinfection Procedure
1. Prior to chlorination, all newly installed water mains and service laterals shall be opened and thoroughly flushed to remove sediments or other debris introduced during the manufacture, transportation, storage, and/or construction processes.
 2. Valve(s) at connection(s) to existing system shall be closed tightly during chlorination process to prevent backflow of highly chlorinated solution into the City Water Supply
 3. All necessary taps shall be made by the Contractor at: (1) tie-ins to existing water distribution system; (2) 1,000 foot intervals along the length of the water main being disinfected; and (3) extreme ends of a system addition. The purpose of these taps is to provide uniform distribution of the strong chlorine solution, sampling of strong solution and sampling for bacteriological contamination.
 4. Disinfection of all additions to, or replacements of, the water distribution system, including fire lines, shall be accomplished using a strong solution of water containing HTH. The HTH solution shall be introduced into the water main by regulated pumping and by operation of: (1) main line valves; (2) lateral valves; and (3) service valves or curb stops. The HTH solution shall be of a concentration that the water main at each sample point shall have a uniform concentration of not less than fifty (50 ppm) parts per million free chlorine and not more than one hundred (100 ppm) parts per million.
 5. Upon authorization by the Engineer, the Contractor shall begin chlorination of the water main by dosing the strong chlorine solution at the sampling point immediately on the downstream side of the valve separating the new water main from the water distribution system. The distribution system valve shall be cracked open allowing a positive flow of water from the water distribution system into the new water main. Simultaneously, the fire hydrant or flushing valve at the far end of the new water main being tested shall be opened in order to provide a positive flow of water to achieve uniform distribution of the strong chlorine

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solution along the entire length of the water main being disinfected. The Laboratory shall sample the chlorine concentration at each sample point sequentially downstream from the dosing point on the water main to determine if the requirement for a uniform concentration of not less than fifty (50 ppm) parts per million free chlorine and not more than one hundred (100 ppm) parts per million free chlorine has been met.

6. The chlorine solution shall remain in contact with the water lines for a minimum of twenty-four (24) hours. At the end of the twenty-four (24) hour contact period, the minimum available chlorine content at each sample point shall be twenty-five (25) ppm.
7. If minimum available chlorine content at any sample point is below twenty-five (25) ppm at the end of the twenty-four (24) hour contact period, then all lines in test shall be rechlorinated.
8. If minimum available chlorine content is equal to or greater than twenty-five (25) ppm at end of twenty-four (24) hour contact period, then the water mains shall be flushed until residual chlorine levels at each sample point on the water main being disinfected is equal to background levels on the existing system (> 1.0 ppm combined chlorine residual).
9. During flushing and testing operations the Contractor shall exercise sufficient precautions to prevent both erosion and damage to property. Flushing duration may have to be limited to lessen impact on surrounding drainage ditches. Temporary retention basins or other measures such as chemical dechlorination, may be necessary to prevent chlorinated water from damaging property or entering natural water courses.
10. Valve boxes shall be installed for each buried valve. Boxes shall be centered over valve operating nut and shall be adjusted to finished ground elevation, unless otherwise directed by the Engineer.

3.03 Bacteriological Testing

1. After flushing has been completed, and the residual chlorine content of the water line being tested is no greater than the residual chlorine content of the source (> 2.0 ppm combined residual chlorine), upon notification by the Engineer, the Laboratory personnel shall conduct bacteriological contamination tests.
2. Test samples to determine bacteriological contamination shall be taken only from 3/4 inch copper services installed directly on the water main. These sampling points shall be provided by the Contractor.
3. Test Samples shall be taken by Laboratory personnel every twenty-four (24) hours for two (2) consecutive business days following flushing and disinfection.
4. The results of each bacteriological contamination test shall be made available to the Engineer thirty (30) hours after taking the bacteriological sample.
5. If positive results are obtained on any test, the Engineer shall instruct the Contractor as to additional flushing and testing. If the Engineer determines that

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flushing and retesting is not sufficient to achieve negative bacteriological test results, then he shall direct the Contractor to rechlorinate the water mains until negative test results are obtained.

- F. Upon obtaining negative test results for two consecutive samples, written notice of the negative bacteriological contamination testing shall be given by the Laboratory to the Water Plant Superintendent, who, in turn, shall give written approval of the water mains tested to the Director of Engineering or his representative. The Director of Engineering shall then give written certification to the Contractor that the water mains may be placed into service. No water mains shall be placed into service until written approval based on satisfactory bacteriological test results is issued by the City of Rocky Mount Water Plant Superintendent, and until written certification is issued by the Director of Engineering stating that the water mains have been installed in accordance with the Drawing and Specifications.

PART 4.00 – MEASUREMENT AND PAYMENT

4.01 Pressure Testing and Disinfection of Water Mains

Work associated with Pressure Testing and Disinfection of Water Mains shall be considered incidental to the work performed during installation of water mains described within Section 15 11 13.

END OF SECTION