

SECTION 25

TESTING AND DISINFECTING WATER MAINS

25-1 General

25-1.01 Scope

This section describes the requirements for pressure and leak testing, and disinfecting of water mains and appurtenances, including but not limited to, air release valve assemblies, blowoff valve assemblies, fire hydrant assemblies, service assemblies, pressure reducing and pump stations, altitude valve stations, and all other appurtenances.

This section does not include disinfecting procedures for water storage tanks. If required, disinfecting of storage tanks is described elsewhere in these specifications.

25-1.02 Description of Work and Materials

This work shall consist of filling the water main and appurtenances with water and bleeding off all entrapped air, allowing the pipe line to soak, making all connections to the water main for expelling air and for testing equipment; running the test, visually inspecting exposed appurtenances, locating and repairing all leaks, retesting, application of disinfectant, and flushing operations.

Materials furnished for this work shall include, but not be limited to, pipe and fittings for connections to the main, pumps, pressure regulator, a calibrated water storage tank, disinfectant, and all other materials, fittings and pipelines required to perform the tests and make the necessary repairs.

25-1.03 Required Work Sequence

The pressure test and the test for allowable leakage shall be performed simultaneously. Testing shall not commence until the water main and all appurtenances have been completely installed, up to and including compaction of road aggregate base. The Contractor may, at any time, perform his own pressure and leak test, however, these tests will in no way offset the requirement for a final pressure and leak test.

After successfully testing the water main and appurtenances and upon District approval, they may then be flushed and disinfected.

Facilities cannot be directly connected to the District until acceptance by the District. System can be separated by a jumper assembly, see District details.

After having been successfully tested and disinfected, the water main may be connected to the District's water system following District approval.

25-1.04 System Operations

Only District personnel shall operate valves and appurtenances that are a part of the treated water system in active service.

25-1.05 Backflow Protection

The Contractor must obtain the approval of the ~~District~~ Engineering Manager, or his or her designee, for any connections between the District's treated water mains or appurtenances and the new water main for the purposes of filling or flushing. All such connections shall be installed with a UL approved backflow prevention device (double check valve assembly or reduced pressure principle type) located at the existing treated water main or appurtenance.

25-2 Testing

25-2.01 General

This section shall consist of testing the water main and appurtenances for both pressure and leakage requirements. These tests will be run simultaneously.

Prior to testing, the water main shall be slowly and carefully filled with water. All air shall be expelled slowly from the pipe and appurtenances in a manner so as not to create excessive surge pressures. All appurtenances shall be left on during the testing procedure.

The Contractor may not test against new or existing valves. Suspected leaking of these valves will not be accepted as a reason for having not passed the leakage test requirements. If an existing valve is suspected of leaking, the Contractor may repair or replace the valve at his own expense, or disconnect the water main from the valve, install a bulkhead, and retest.

25-2.02 Test Section Length

The length of water main being tested at any one time shall not exceed 2,000 feet unless otherwise approved by the ~~District~~ Engineering Manager, or designee, or allowed in the Special Conditions of this Contract.

25-2.03 Testing Equipment

The Contractor shall be responsible for supplying, maintaining, and operating all testing equipment. In general, the testing equipment configuration shall consist of a pump receiving water from a calibrated storage tank. The pump discharge shall enter the water main through a tap or appurtenance. A pressure sustaining valve capable of being adjusted within the required pressure ranges shall be placed on a tee located in the pump discharge line. Discharge from the pressure sustaining valve shall return to the calibrated storage tank. Other types or configurations of testing equipment shall be subject to approval by the ~~District~~ Engineering Manager, or designee. The pressure pump and pressure sustaining valve shall remain in operation continuously throughout the test period.

25-2.04 Test Pressure

The test pressure shall be 150% of the working pressure, as calculated for the lowest elevation of the test section, or 150 psi, whichever is greatest. The pressure maintained at the pump shall be adjusted for the difference in elevation between the lowest elevation of the test section and the pump location. Each valve shall be tested on at least one side to hold pressure with little loss.

25-2.05 Test Duration

The test duration shall be 2 hours. Pressure in the water main shall be maintained as near the calculated test pressure as possible for the full two hour duration. The pressure pump and pressure sustaining valve shall remain in operation continuously throughout the duration of the test.

25-2.06 Allowable Leakage

The allowable leakage per test section shall be calculated from the formula contained in this subsection. Different sized water mains that might be contained within the same test section shall be calculated separately and their allowable leakage added together. This formula represents the allowable leakage regardless of the number of joints, couplings, fittings, valves, pressure reducing or pump station or any other appurtenances on the water main. The length of pipe contained in these appurtenances shall not be counted as adding to the length of water main being tested. All testing shall follow the appropriate AWWA pressure standard.

$$V = \frac{LD}{148,000} (P^{1/2})$$

Where:

V = Allowable leakage in gallons per hour.

L = Length of water main in feet.

D = Nominal diameter in inches.

P = Average test pressure in psi**

** The average test pressure shall be calculated as the test pressure for the lowest elevation of the test section less one-half the elevation change to the highest point on the test section.

25-2.07 Repairs

During the pressure and leakage test, all accessible appurtenances shall be inspected for visual signs of leakage. All visual leaks shall be corrected immediately, regardless of the amount of leakage and the test shall be run again for its full duration. Should the pressure and leakage test fail, the Contractor shall begin to investigate all areas of suspected leakage and shall make all repairs necessary in order to affect a successful test. All repair methods shall be subject to District Engineering Manager approval. All leaks detected shall be repaired to a water tight condition. All repairs made shall be retested in accordance with these specifications. All repairs shall be made and a successful test accomplished prior to taking bacteriological samples.

25-3 Disinfecting

25-3.01 General

The interior of all water mains and appurtenances shall be disinfected in accordance with AWWA C651 and these specifications. Disinfection requirements shall include preventive and

corrective measures during construction, forms of chlorine and methods of application, final flushing, and bacteriological tests.

The methods and techniques described in these specifications are minimum requirements only. The Contractor shall be solely responsible for the methods and techniques used to successfully disinfect the water mains and appurtenances and for disposing of the highly chlorinated water during flushing operations.

25-3.02 Preventive and Corrective Measures During Construction

Precautions shall be taken to protect the interior of water mains and appurtenances against contamination. The open ends of all water main installed in the trench shall be closed with water tight plugs when pipe laying has stopped. Stockpiled pipe and appurtenances shall also be protected from contamination.

Any cut-ins or short sections of pipe that require water service and placed in service shall be done as soon as possible and shall follow AWWA procedure C651-14, Section 4.11.

If dirt or other contaminants enter the water main or appurtenances and, in the opinion of the District Engineering Manager, the contaminate will not be removed by the flushing operation, the interior surfaces shall be cleaned by mechanical means.

Water mains and appurtenances flooded during construction shall be cleared of flood water, flushed with potable water, isolated, and filled with chlorinated water so that at the end of a 24-hour holding period, the free chlorine residual is not less than 25 mg/L. The chlorinated water shall be flushed as described under Final Flush of these specifications.

25-3.03 Methods of Chlorination

Two methods of chlorination are accepted: tablets, and continuous feed. The slug method described in AWWA C651 will not be allowed.

25-3.03-A Tablet Method

This method may be used only if the mains and appurtenances are kept clean and dry during construction. The placing of calcium hypochlorite granules in addition to the tablets during construction is optional.

Calcium hypochlorite, 65-percent, 5-gram tablets shall be attached to the top inside surface of each length of pipe immediately prior to installation with a food-grade adhesive. Use only Permatex Form-a-Gasket No. 2, or Permatex Clear RTV Silicon Adhesive Sealant, or approved equal. Do not use Permatex Form-a-Gasket No. 1. The number of tablets for each pipe section shall be calculated as the following:

$$N = .0012d^2L$$

Where:

N = Number of 5-gram tablets required for each pipe section, rounded to the next higher integer.

d = Nominal pipe diameter in inches.

L = Length of each pipe section in feet.

When installation has been completed, the water main shall be filled with water at a rate so as not to create a velocity of more than 1 ft/sec. All air pockets shall be eliminated. The heavy chlorine solution shall remain in the mains at least 24 hours. If water temperatures below 41°F, it shall remain for at least 48 hours.

25-3.03-B Continuous-Feed Method

This method shall consist of filling the completed mains and appurtenances to remove all air pockets, flushing to remove particulates, and refilling the mains with potable water chlorinated so that after a 24-hour holding period in the mains, there will be a free chlorine residual of not less than 10 mg/L.

The methods and techniques used for preliminary flushing and chlorinating the mains shall be as described in Section 4.4.2 - 4.7, AWWA C651-14. The placing of calcium hypochlorite granules during construction is optional.

25-3.04 Final Flushing

The heavily chlorinated water shall be flushed with potable water from the mains and appurtenances and shall not remain in the mains more than 48 hours beyond the times required in this section. The heavily chlorinated water shall be flushed from the mains and appurtenances until chlorine measurements show that the concentrations in the water leaving the main is no higher than that generally prevailing in the system, but not more than 1.0 mg/L.

The environment to which the chlorinated water is to be discharged shall be inspected. The Contractor shall be solely responsible for any damage caused by the discharge of heavily chlorinated water. If there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. Reducing agents and their use shall comply with AWWA C651, Appendix B. Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water. Final connections shall follow AWWA specifications (Section 4.10).

25-3.05 Bacteriological Samples

Upon completion of the disinfection process, water samples shall be tested for bacteriological quality in accordance with AWWA "Standard Methods for the Examination of Water and Wastewater" and AWWA 651-14, Sec. 5.1 specifications, and shall show the absence of coliform organisms.

Bacteriological samples shall be collected by the District and tested at a laboratory approved by the District Engineering Manager. The number and location of samples shall be determined by the District Engineering Manager. Should any of the samples prove positive, the Contractor shall repeat the disinfecting process and the District will again collect samples for testing.

25-3.06 Redisinfection

If the initial disinfection fails to produce satisfactory bacteriological samples, the main may be reflushed and shall be resampled. If these second check samples continue to show the

presence of coliform organisms, then the main shall be rechlorinated by the continuous-feed method of chlorination until satisfactory results are obtained.

25-4 Measurement and Payment

25-4.01 Measurement

Measurement shall be on a lump sum basis. Partial payment for testing and disinfecting will not be considered except for approved isolated sections of pipeline that have been successfully tested and disinfected. In these cases, the amount of work completed will be calculated as the length of Water Main successfully tested and disinfected as it compares to the total length of Water Main to be installed under this Contract.

25-4.02 Payment

The Contract lump sum price shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work necessary for the Testing and Disinfecting of water main and appurtenances. A description of the work is included at the head of this section. Any work associated herewith, but not included in other bid items, shall be deemed as included in the work described in this section.