

TESTING AND DISINFECTION**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Pressure and Leak Testing of Water System
- B. Disinfection of Potable Water Systems

1.02 DESCRIPTION OF WORK

Test and disinfect water mains, valves, fire hydrants, and appurtenances.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

- A. Notify the Engineer two working days in advance of testing or disinfection operations to coordinate the operations.
- B. The Engineer or his/her representative is required to be in attendance during testing or disinfection.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

Testing and disinfection of water systems is incidental to the construction of pipe and fittings.

PART 2 - PRODUCTS

2.01 DISINFECTION AGENT - CHLORINE

- A. Liquid Chlorine complying with AWWA B300 and AWWA B301.
- B. Sodium Hypochlorite complying with AWWA B300.
- C. Calcium Hypochlorite complying with AWWA B300.
- D. All disinfecting agents to be NSF 60 certified. Supply and store in the original container.

PART 3 - EXECUTION**3.01 GENERAL**

Perform operations according to AWWA C651 in the sequence below. Successfully complete each operation specified in subsections 3.02 through 3.08 below before continuing to the next operation. The Jurisdiction will provide reasonable quantities of water for flushing and testing.

3.02 SEQUENCE OF TESTING AND DISINFECTION

A. Continuous-Feed or Slug Method (After Water Main Installation): The sequence of testing and disinfection may be modified with approval of the Engineer.

1. Perform initial flush.
2. Perform disinfection.
3. Flush after disinfection.
4. Perform pressure and leak testing.

B. Tablet Method (Concurrent with Water Main Installation): Use this method only if approved by the Engineer. Modify the procedure for flushing, disinfection, and pressure and leak testing as needed if tablet method is used.

1. Perform disinfection.
2. Flush after disinfection.
3. Perform pressure and leak testing.

3.03 INITIAL FLUSHING**A. Flushing:**

1. Coordinate flushing with the Jurisdiction.
2. Flush pipe prior to disinfection using potable water.
3. Measure flushing velocity.
4. Obtain a minimum flushing velocity of 3 feet per second in the pipe to be disinfected.

B. Minimum Flushing Rate: According to AWWA C651, Table 3, based on 40 psi residual pressure (see table below).

Table 5030.01: Minimum Flushing Rate

| Pipe Diameter (inches) | Flow Rate for Flushing (gpm) | Number of Taps ² | | | Number of 2 1/2" Fire Hydrant Outlets ¹ |
|---------------------------|---------------------------------|-----------------------------|--------|----|-------------------------------------------------------|
| | | 1" | 1 1/2" | 2" | |
| 4 | 120 | 1 | - | - | 1 |
| 6 | 260 | - | 1 | - | 1 |
| 8 | 470 | - | 2 | - | 1 |
| 10 | 730 | - | 3 | 2 | 1 |
| 12 | 1,060 | - | - | 3 | 2 |
| 16 | 1,880 | - | - | 5 | 2 |

¹With a 40 psi pressure in the main with the fire hydrant flowing to atmosphere, a 2 1/2 inch fire hydrant outlet will discharge approximately 1,000 gpm; and a 4 1/2 inch fire hydrant outlet will discharge approximately 2,500 gpm.

²Number of taps on pipe based on discharge through 5 feet of galvanized iron pipe with one 90° elbow.

3.03 INITIAL FLUSHING (Continued)

- C. Property Protection:** Protect public and private property from damage during flushing operations.

3.04 PRESSURE AND LEAK TESTING

- A. Remove debris from within the pipe. Clean and swab out pipe, if required.
- B. Secure unrestrained pipe ends against uncontrolled movement.
- C. Isolate new piping from the existing water system.
- D. Fill and flush all new piping with potable water. Ensure all trapped air is removed.
- E. Pressurize the new pipe to the test pressure at the highest point in the isolated system. Do not pressurize to more than 5 psi over the test pressure at the highest point in the isolated system.
- F. Test and monitor the completed piping system at 1.5 times the system working pressure or 150 psi, whichever is greater, for 2 continuous hours.
- G. If at any time during the test the pressure drops to 5 psi below the test pressure, repressurize the pipe by pumping in potable water in sufficient quantity to bring the pressure back to the original test pressure.
- H. Accurately measure the amount of water required to repressurize the system to the test pressure.
- I. Maximum allowable leakage rate:

$$L = \frac{(S)(D)(P)^{0.5}}{148,000}$$

Where:

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal pipe diameter, in inches

P = average test pressure, in pounds per square inch

The following table assumes an average test pressure (P) of 150 psi and 1,000 feet of test section.

Table 5030.03: Maximum Allowable Leakage Rate

| Pipe Diameter (inches) | Allowable Leakage Rate (gallons/hour/1,000 feet of pipe) |
|-----------------------------------|---------------------------------------------------------------------|
| 4 | 0.33 |
| 6 | 0.50 |
| 8 | 0.66 |
| 10 | 0.83 |
| 12 | 0.99 |
| 14 | 1.16 |
| 16 | 1.32 |
| 18 | 1.49 |
| 20 | 1.66 |
| 24 | 1.99 |
| 30 | 2.48 |
| 36 | 2.98 |

3.04 PRESSURE AND LEAK TESTING (Continued)

- J. If the average measured leakage per hour exceeds the maximum allowable leakage rate, repair and retest the water main.
- K. If the measured pressure loss does not exceed 5 psi, the test will be considered acceptable.
- L. Repair all visible leaks regardless of the amount of leakage.

3.05 DISINFECTION**A. General:**

1. Disinfect according to AWWA C651. The tablet method contained in AWWA C651 is not to be used unless approved by the Engineer.
2. Keep piping to be chlorinated isolated from lines in service and from points of use.
3. Coordinate disinfection and testing with the Engineer.

B. Procedure:

1. Induce a flow of potable water through the pipe.
2. Introduce highly chlorinated water to the pipe at a point within 5 pipe diameters of the pipe's connection to an existing potable system, or within 5 pipe diameters of a closed end, if there is no connection to an existing system.
3. Introduce water containing a minimum of 25 mg/L free chlorine until the entire new pipe contains a minimum of 25 mg/L free chlorine.
4. Retain chlorinated water in the pipe for at least 24 hours and no more than 48 hours.

3.06 FINAL FLUSHING

- A. Flush pipe using potable water until chlorine residual equals that of the existing potable water system.
- B. Dispose of chlorinated water to prevent damage to the environment. Dechlorinate highly chlorinated water from testing before releasing into the ground or sewers. Obtain Jurisdiction approval prior to flushing activities.
 1. Check with the local sewer department for the conditions of disposal to the sanitary sewer.
 2. Chlorine residual of water being disposed will be neutralized by treating with one of the chemicals listed in the following table.

3.06 FINAL FLUSHING (Continued)**Table 5030.02: Amounts of Chemicals Required to Neutralize Various Residual Chlorine Concentrations in 100,000 Gallons of Water**

| Residual Chlorine Concentration mg/L | Sulfur Dioxide (SO ₂) lb | Sodium Bisulfite (NaHSO ₃) lb | Sodium Sulfite (Na ₂ SO ₃) lb | Sodium Thiosulfate (Na ₂ S ₂ O ₃ + 5H ₂ O) lb | Ascorbic Acid (C ₆ O ₈ H ₆) lb |
|--------------------------------------|--------------------------------------|-------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 1 | 0.8 | 1.2 | 1.4 | 1.2 | 2.1 |
| 2 | 1.7 | 2.5 | 2.9 | 2.4 | 4.2 |
| 10 | 8.3 | 12.5 | 14.6 | 12.0 | 20.9 |
| 50 | 41.7 | 62.6 | 73.0 | 60.0 | 104 |

3.07 BACTERIA SAMPLING

Test water mains according to AWWA C651, except as modified below:

- A. Collect samples every 1,200 feet of new water main plus one set from the end of the line and at least one from each branch greater than one pipe length. If trench water entered the new main during construction, or if excessive quantities of dirt and debris entered the main, reduce the sampling interval to every 200 feet of new main.
- B. Collect samples according to one of the following methods as directed by the Engineer:
 1. Collect an initial set of samples after flushing and then an additional set after a minimum of 24 hours without any water use. The engineer may reduce the sampling interval to 16 hours.
 2. Allow water to sit in the new main for a minimum of 16 hours after flushing without any water use. Collect an initial set of samples and allow the sampling ports to run for a minimum of 15 minutes. Collect a second set of samples from the sampling ports.

3.08 RE-DISINFECTION

If the initial disinfection fails to produce satisfactory bacteriological samples, flush the main again and reinitiate the sampling process. If check samples show the presence of coliform organisms, re-chlorinate the main prior to flushing and sampling until satisfactory results are obtained.

3.09 PUTTING WATER MAIN IN SERVICE

Put the completed water system in service only after both sets of bacterial samples have passed and obtaining permission from the Jurisdiction.

END OF SECTION