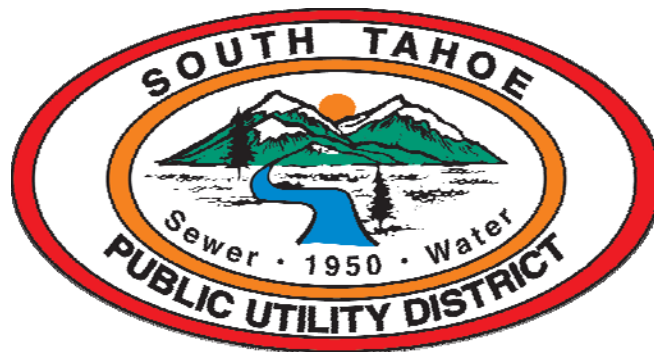


WATER SYSTEM CONNECTION DISINFECTION AND TESTING GUIDE



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Definitions

<i>District:</i>	South Tahoe Public Utility District
<i>Owner:</i>	The party (private or public) for which a Contractor is performing work on the District's water system
<i>Contractor:</i>	A Contractor licensed by the State of California to perform the type of work proposed on the District's water system on behalf of the Owner.
<i>Chlorine Residual:</i>	Concentration of chlorine species present in water after the oxidant demand has been satisfied.
<i>Sodium hypochlorite:</i>	Sodium hypochlorite contains approximately 5 percent to 15 percent available chlorine

I. Introduction

This Disinfection and Testing Guide has been developed to instruct Contractors in the minimum accepted methods by which new water connections to the existing public water system are tested and disinfected for acceptance. The methods that will be presented are from the latest edition of the American Water Works Association (A.W.W.A) Disinfection Procedures C651, and the District's Standard Specifications. The Contractor shall not deviate from any of the requirements of this Guide without written District consent. At no time shall a new portion of pipeline be connected to the District's existing Water System until the new pipeline has been properly disinfected and has passed all bacteriological tests.

II. Procedure

Prior to beginning work Owner or Contractor shall develop and provide to the District a written Disinfection Procedure incorporating the requirements below. Only liquid chlorine, Sodium Hypochlorite is allowed to be used for disinfection. Potable water may be supplied from a temporary backflow-protected connection to the existing distribution system or other supply source approved by the District. The backflow assembly shall be a District tested and Approved Reduced Pressure Principle backflow assembly (**see Figure 1**).

III. Initial Tie In Connection

Tie in to the existing District's Water System will be conducted by Hot Tap or Cut In method.

Cut-In Method

Cut In method may be performed by the Contractor, and must be closely coordinated with District Staff to notify affected Customers and to facilitate the shut-down of the District's Water System at the Tie in point. **At no time is the Contractor or any other non-District personnel allowed to operate existing valves on the District's Water System.** The installation work must be conducted in a safe and sanitary condition. The pipe trench shall be continuously dewatered to maintain the water level well below the open pipe ends. All new materials to be installed, tools, and all exposed surfaces of the existing pipe shall be kept clean and sanitary by spraying and swabbing with sodium hypochlorite.

Hot Tap Method

If a Hot Tap is selected, the work to tap the main will be performed by the District, with advance notice. The saddle and valve are to be provided and installed on the main by the Owner's Contractor. Scheduling with District for Hot Tap or Shut Down shall be in writing a minimum of 2 working days. Following the hot tap, disinfection and bacteriological tests will be conducted by trained District personnel from a nearby sampling location on the existing system.

IV. Leak Testing

Assembled piping and appurtenances from the point of tie in at the existing District Water System to the terminus point of the new pipeline (generally defined by a service valve or backflow protection device), shall be tested for leaks. The method of leak testing shall be determined based on the assembled length of the new piping and appurtenances (fittings and valves).

Assembled Length of 20 linear feet or less

Assembled piping of 20 linear feet (lf) or less shall be visually inspected for leaks by District personnel after it has been assembled, disinfected, installed, and charged. To facilitate inspection, the Contractor shall not backfill the trench until

after the new piping is charged to system pressure, and District personnel have completed the visual inspection. For safety, the Contractor is required to restrain and/or brace the exposed piping to District satisfaction before the line is charged by the District. **At no time is the Contractor or any other non-District personnel allowed to operate existing valves on the District's Water System.**

Assembled Length of greater than 20lf

Assembled piping of greater than 20lf shall be hydrostatically pressure-tested prior to being disinfected and connected to the District's Water System, for a minimum of 2 hours at the rated pressure for the assembled piping (typically 150 psi), as measured at the lowest point in the line. To test, accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period. Successful completion of the pressure test with maximum leakage allowance shall have been achieved when the observed leakage during the test period is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred. Calculate the allowable leakage by the following formula.

$$L = \frac{(S * D * \sqrt{P})}{133,200}$$

Wherein the terms shall mean:

L = Allowable leakage in gallons per hour.

S = Length of the test section in feet.

D = Nominal diameter of the piping in inches.

P = Average observed test pressure in pounds per square inches, gauge, at the lowest point of the test section, corrected for elevation of the pressure gauge.

V. Disinfection

New tie-in fittings and valves shall not be connected to the District's Water System until they have been disinfected. New piping shall not be connected to the tie-in fittings and valves until it has been disinfected, flushed (if necessary) and tested. The method of disinfection shall be determined based on the assembled length of the new piping and appurtenances (fittings and valves), from the point of tie in at the existing District Water System to the terminus point of the new pipeline (generally defined by a service valve or backflow protection device).

Assembled Length of 20 linear feet or less

Pipeline installations of 20 linear feet (lf) or less shall be spray disinfected and swabbed with sodium hypochlorite immediately before being installed. Because the entire interior of the assembled piping is visible, it shall be inspected for particulate contamination and re-swabbed, if necessary, prior to installation; flushing is not required.

Assembled Length of greater than 20lf

Pipeline installations of greater than 20lf shall be protected from contaminating materials from entering the pipe and appurtenances during storage, construction, or repair and noting potential contamination at the construction site. Upon completion of installation and successful hydrostatic testing as required by District, remove particulate materials that may have entered the water main or appurtenances by flushing or other means, prior to proceeding with disinfection. The flushing velocity in the main shall not be less than 3.0 ft/sec. **Table 1** shows the rates of flow required to produce a velocity of 3.0ft/sec. in commonly used sizes of pipe. (NOTE: flushing is no substitute for preventive measures during construction. Certain contaminants, such as caked deposits, resist flushing at any feasible velocity, and

pigging of the main, or other suitable method acceptable to the District, may be required.) Where such flow rates are not possible, flushing at the maximum expected flow rate for the line for 2-3 volumes may be allowed with approval from the District.

To disinfect, at a point not more than 5 ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25mg/L free chlorine. To ensure that an appropriate concentration is achieved, the free chlorine concentration shall be measured at regular time intervals in accordance with the procedures described. **Table 2** gives the amount of chlorine required for each 100 ft of pipe for various pipe diameters. Solutions with a minimum 1 percent chlorine concentration may be prepared with sodium hypochlorite. Chlorine application shall not cease until the entire main is filled with chlorinated water. The chlorinated water shall be retained in the main for at least 24 hr., during which time valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of this 24-hr period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L of free chlorine as determined by District Lab personnel. After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use. Chlorinated water shall be disposed of appropriately, and shall not be discharged to the District's Sewer System without prior written consent. After disinfection, the chlorinated water in the new pipe shall be replaced with water at background chlorine level, prior to collecting samples for bacteriological testing.

VI. Bacteriological Testing

Bacteriological Testing will be performed on all assembled piping.

Assembled Length of 20 lf or less

Samples will be collected by District personnel from a nearby sampling port on the existing system after the new piping has been connected to the system.

Assembled Length of greater than 20lf

Prior to connection of the new piping to the existing system, District staff will collect samples for every 1,200ft of the new pipeline and appurtenances, plus one set from the end of the line and at least one from each branch greater than one pipe length, for a minimum of three test sites per 1200 feet of new assembled piping. The sample ports shall be installed by the Contractor (see **Figure 2**). The District has two options for the bacteriological testing for total coliform analysis.

Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hr. using the sampling site procedures outlined. Both sets of samples must pass for the main to be approved by the District's lab for release.

Option B: Before approving a main for release, let it sit for a minimum of 16 hr. without any water use. Then collect, using the sampling site procedures outlined and without flushing the main, two sets of samples a minimum of 15 min apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release. A standard Heterotrophic Plate Count (HPC) test may be required at the option of the District because new mains do not typically contain coliform bacteria but often contain HPC bacteria. If sample results show HPC greater than 500 CFU/mL,

flushing should resume and another set of HPC and coliform samples collected until no coliform are present and the HPC is less than 500 CFU/mL. If the initial disinfection fails to produce satisfactory bacteriological results, or if other results indicate unacceptable water quality, the main may be reflushed and shall be resampled. If check samples fail to produce acceptable results, the main shall be rechlorinated until satisfactory results are obtained.

VII. Final Connection

Assembled Length of greater than 20lf

Water mains and appurtenances must be completely assembled, flushed (when required), disinfected, and satisfactory bacteriological sample results received (when required) prior to permanent connections being made to the active distribution system. Sanitary construction practices must be followed during installation of the final connection so that there is no contamination of the new or existing water main with foreign material or groundwater.

Comments

If you have any questions about this Guide please call the South Tahoe public Utility District Engineering Department at 530.544.6474.

Figure 1
Suggested temporary flushing/testing connection

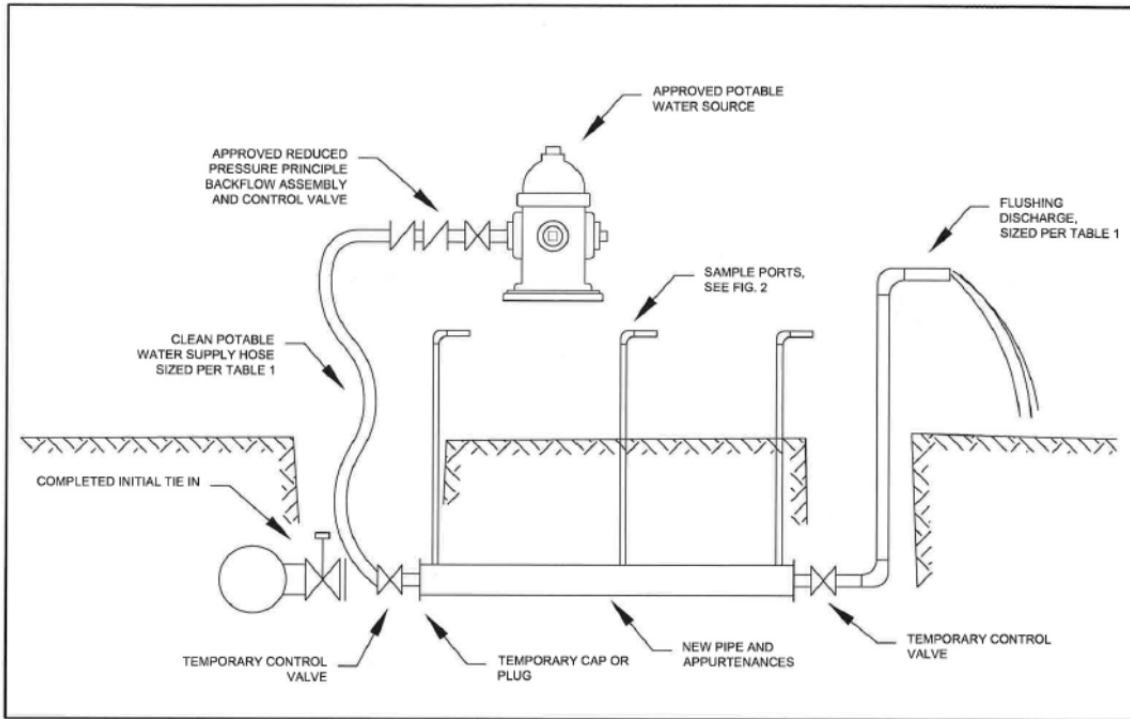


Figure 2
Typical Sample Port

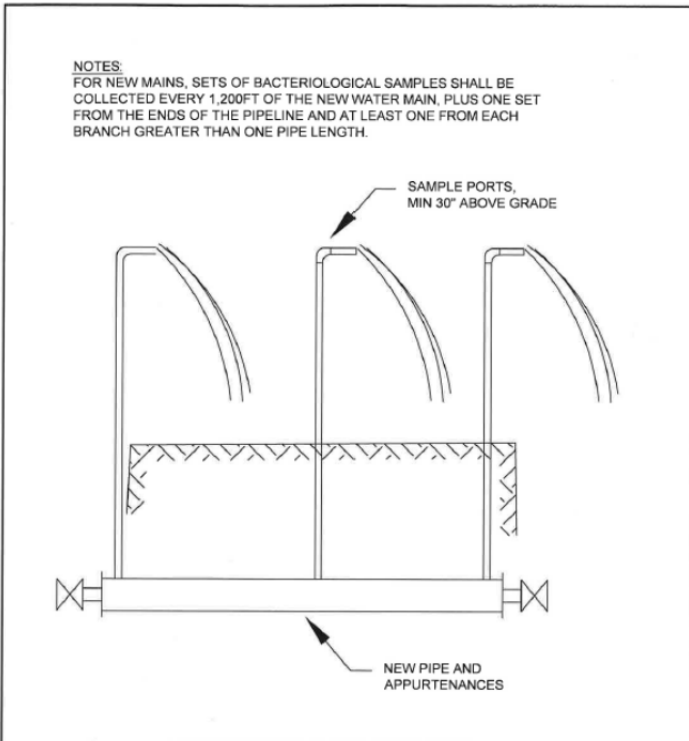


Table 1
South Tahoe Public Utility District
Disinfection and Testing Guide
Updated: July 2016 (V1-jhr)

Required flow and openings to flush pipelines at 3.0ft/sec

New Pipe Diameter	GPM Flow Required to Produce 3.0ft/sec.	Size of Supply	Size of FH Supply	Size of Discharge Flushing
4"	120	2"	2½"	2"
6"	260	2"	2½"	2"
8"	470	Two 2"	2½"	4"
10"	730	Two 2"	2½"	4"
12"	1,060	Three 2"	4½"	6"

Table 2

Chlorine required to produce an initial 25mg/L concentration in 100ft of pipe by diameter

New Pipe Diameter	100% Chlorine	1% Chlorine
4"	0.013lb	0.16gal
6"	0.030lb	0.36gal
8"	0.054lb	0.65gal
10"	0.085lb	1.02gal
12"	0.120lb	1.44gal