

SECTION 02600 - DISINFECTION OF PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED IN THIS SECTION

- A. The WORK of this Section includes requirements for disinfection of water mains, services, appurtenances and connections by chlorination.

PART 2 - PRODUCTS

2.1 LIQUID CHLORINE (GAS)

- A. Liquid chlorine shall contain 100-percent available chlorine packaged in steel cylinders in net weights of 150 LB or 1 ton.
- B. Liquid chlorine shall be used with appropriate gas flow chlorinators, heaters, and injectors to provide a controlled high concentration solution feed. The chlorinators and injectors shall be vacuum operated type.

2.2 SODIUM HYPOCHLORITE (LIQUID)

- A. Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 1 QT to 5 GAL. This liquid solution contains approximately 5-percent to 15-percent available chlorine.
- B. Sodium hypochlorite to be used for pipeline disinfection shall be tested for consistency of strength.

PART 3 - EXECUTION

3.1 GENERAL

- A. All water mains, water services, appurtenances, and connections, if any, shall be disinfected in accordance with AWWA C651 except as modified herein. The slug method shall not be permitted.
- B. All new water mains and temporary high lines shall be disinfected, sampled and pass bacteriological testing before they are connected to the DISTRICT's existing system. All water mains and appurtenances taken out of service for inspection, repairs, or other activity that might lead to contamination shall be disinfected before they are returned to service.
- C. All water mains and appurtenances taken out of service for inspection, repairs or other activities that might lead to contamination shall be disinfected, sampled and pass bacteriological testing before they are returned to service.

- D. The CONTRACTOR shall be responsible for documenting all disinfection practices performed in making pipeline connections, repairs or for other reasons that the DISTRICT may require.
- E. High concentrations of particulates generally containing bacteria prevent even very high chlorine concentrations from contacting and killing such organisms. Therefore, water mains and appurtenances shall be maintained clean and dry during the installation process.
- F. Pipe, valve and fitting materials which, in the opinion of the DISTRICT, becomes overly contaminated shall be cleaned by mechanical means and then swabbed with a 5-percent hypochlorite disinfecting solution prior to installation or replaced if directed by the DISTRICT.
- G. Water mains under construction flooded by storm water, run off, sewage or ground water, shall be cleaned of the flood water by draining and flushing with metered potable water, equipped with an approved BFD. The section exposed to the flood water shall be filled with chlorinated potable water that, at the end of a 24-hour holding period, will have a minimum total chlorine residual of 25 mg/1. After construction is completed, the entire main shall be disinfected using the liquid chlorine (gas) method.
- H. Disinfection of pipelines shall not proceed until authorized by the DISTRICT.
- I. Disinfection of pipelines shall not proceed until all appurtenances have been installed.
- J. Disinfection shall result in an initial minimum total chlorine concentration of 50 mg/1. This concentration shall be evenly distributed throughout the system to be disinfected. The chlorinated water shall be retained in the system for a minimum of 24 hours. The system shall contain a total chlorine residual of not less than 25 mg/1 at the end of the 24-hour retention period.
- K. During the disinfection process, all valves shall be operated. Appurtenances shall be flushed with the treated water a sufficient length of time to insure a chlorine concentration of 50 mg/1 in each appurtenance.

3.2 METHODS

- A. Liquid Chlorine (Gas)
 - 1. Liquid chlorine (gas) shall be used to disinfect all potable water pipelines and temporary high lines, regardless of size or material composition unless the DISTRICT approves the use of hypochlorite solution upon CONTRACTOR request.
 - 2. Only a certified, licensed chlorination and testing contractor shall perform gas chlorination work. Only vacuum type equipment shall be used. Direct-feed chlorinators which operate solely from gas pressure in the chlorine cylinder shall not be permitted.

3. Injection feed waters will be required to have an approved BFD at the supply water source point to the chlorine injector.
4. The chlorinating agent shall be applied at the beginning of the system to be chlorinated and shall be injected through a corporation stop, a hydrant, or other approved connection to ensure treatment of the entire system being disinfected.
5. All Federal, State and Local laws, ordinances, orders, etc., shall be strictly adhered to.

B. Sodium Hypochlorite Solution

1. Sodium hypochlorite solution shall be used for cleaning and swabbing materials immediately prior to installation.
2. Sodium hypochlorite solution shall be used, only as directed by the DISTRICT, to adjust the total chlorine residual to 50 mg/1 after the initial filling and liquid (gas) chlorination of the system.
3. Sodium hypochlorite shall be added to the system in the amount and in the places as directed by the DISTRICT.
4. The pump equipment to be used for the injection of sodium hypochlorite solution shall be approved by the DISTRICT.
5. Sodium hypochlorite solution shall not be used as a substitute for liquid chlorine (gas) chlorination, unless approved by DISTRICT as primary disinfection agent.
6. Injection pumps or feed injectors will be required to have an approved BFD at the supply water point of connection.

3.3 CONCURRENT TESTING

- A. Disinfecting the mains and appurtenances, hydrostatic testing, and the retention time may run concurrently for the required 24-hour period. In the event repairs are necessary, additional disinfection maybe required by the DISTRICT. This disinfection shall be made by either the liquid chlorine (gas) method, or the sodium hypochlorite method, as directed by the DISTRICT.

3.4 FLUSHING

- A. Flushing of pipeline systems shall adhere to the requirements of AWWA C651.
- B. In order to obtain sufficient scouring and cleaning of the pipeline system, proper water velocity during the flushing operation is necessary. The minimum water velocity during flushing shall be 2.5 feet per second (fps), but 3 fps is recommended.

- C. The CONTRACTOR shall be responsible for the installation of appropriate temporary piping and connections necessary to attain the prescribed flushing velocity.
- D. After the 24-hour retention period, and upon approval from the DISTRICT, the chlorinated water shall be flushed from the system, at its extremities and at each appurtenance. Flushing shall continue until the replacement water in the new system is equal chemically and bacteriologically to the permanent source of supply.
- E. The environment to which the chlorinated water is to be discharged shall be inspected by the CONTRACTOR. If there is any question that the chlorinated discharge will cause damage to the environment, a dechlorinating agent shall be applied to the water as it exits the piping system to neutralize the chlorine residual.
- F. Where necessary, Federal, State and Local regulatory agencies should be contacted to determine special provisions for the disposal of highly chlorinated water.
- G. When required by the local authority (City, County, or State), the CONTRACTOR may be responsible for recovering flushed water containing chlorine residual to meet storm water regulations.
- H. Under no circumstances shall the DISTRICT be responsible for loss or damage resulting from such disposal.

3.5 BACTERIOLOGICAL TESTING

- A. The DISTRICT shall perform bacteriological sampling and testing of all new system installations. The testing methodology employed by the DISTRICT is as set forth in "Standard Methods for the Examination of Water and Waste Water" (current edition).
- B. Testing requirements are as set forth in the California Domestic Water Quality and Monitoring Regulations and commensurate with current requirements for surface water testing.
- C. The DISTRICT will analyze the samples for the presence of coliform bacteria and heterotrophic type bacteria (heterotrophic plate count). The evaluation criteria employed by the DISTRICT for a passing test sample is currently as follows:
 - 1. coliform bacteria: no positive sample, and
 - 2. heterotrophic plate count (HPC): less than 500 colony forming units/ml
- D. Failure to pass said examination shall require the CONTRACTOR to take remedial steps as deemed necessary by the DISTRICT, and as detailed herein.

3.6 REDISINFECTION

- A. If the initial disinfection fails to produce satisfactory bacteriological results, the pipeline system shall be re-flushed and shall be resampled.
- B. If the second set of samples do not produce satisfactory results, the pipeline system shall be re-chlorinated by the liquid chlorine (gas) method, flushed, and resampled. This chlorination, flushing, and sampling procedure shall continue until satisfactory results are obtained.
- C. Re-disinfection and re-testing shall be at the CONTRACTOR's expense.

END OF SECTION