

SECTION 15041
DISINFECTION OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION.

This section describes requirements for disinfection by chlorination of potable water mains, services, pipe appurtenances and connections.

1.02 REFERENCED STANDARDS.

The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

AWWA B300	Standard for Hypochlorites
AWWA B301	Standard for Liquid Chlorine
AWWA C651	Disinfecting Water Mains

1.03 RELATED WORK SPECIFIED ELSEWHERE.

- A. AWWA Standard Methods for the Examination of Water and Waste Water
- B. VCMWD Standard Specifications 15000, 15044, 15056, 15057, 15061, and 15064

1.04 SERVICE APPLICATION.

A. 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 AWWA C651.

B. All new water mains and temporary pipelines shall be disinfected prior to connection to the District's existing system.

C. All components incorporated into a connection to the District's existing system shall be disinfected prior to installation.

1.05 SUBMITTALS.

A written disinfection and dechlorination plan, including all methods and equipment to be used, shall be signed by the person responsible for performing the work and shall be submitted to the District Engineer for approval prior to starting disinfection operations.

1.06 DELIVERY, STORAGE AND HANDLING.

Chlorination and dechlorination shall be performed by competent individuals knowledgeable and experienced in the operation of the necessary application and safety equipment in accordance with applicable Federal, State and Local laws and regulations. The transport, storage and handling of these materials shall be performed in accordance with Code of Federal Regulations (CFR)1910.120 Hazardous Waste Operations and Emergency Response, CFR 49.172 Hazardous Materials Regulations, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5194.

1.07 CONCURRENT DISINFECTION AND HYDROSTATIC TESTING.

The specified disinfection of the pipelines may *not* be performed concurrently with the hydrostatic testing.

1.08 CONNECTION TO EXISTING MAINS.

Prior to connection to existing mains, disinfection and bacteriological testing shall be performed in accordance with this specification, and hydrostatic testing shall be performed per Section 15044. District authorization for connection to the existing system shall be given only on the basis of acceptable hydrostatic, disinfection and bacteriological test results. Connection to existing mains shall be performed in accordance with Section 15000.

PART 2 - MATERIALS

2.01 SODIUM HYPOCHLORITE (LIQUID).

Sodium hypochlorite is available in liquid form in glass or plastic containers, ranging in size from 1 Qt. to 5 Gal. The solution contains approximately 10% to 15% available chlorine.

2.02 TABLET OR GRANULAR HYPOCHLORITE.

Calcium Hypochlorite conforming to ANSI/AWWA B300 is available in granular form. It must contain approximately 65% available chlorine by weight. CAUTION: The tablets dissolve in approximately 7 hours and must be given adequate contact time. The use of calcium hypochlorite intended for swimming pool disinfection is strictly prohibited.

2.03 GAS CHLORINE.

Liquid Chlorine applied in the gaseous state shall NOT be allowed with the District or within the District boundaries.

PART 3 - EXECUTION

3.01 GENERAL.

A. Disinfection of pipelines shall not proceed until all appurtenances and any necessary sample ports have been installed and the Engineer provides authorization.

B. Every effort shall be made to keep the water main and its appurtenances clean and dry during the installation process.

C. All piping, valves, fillings, and appurtenances which become contaminated during installation shall be cleaned, rinsed with potable water, and then sprayed or swabbed with a 5 percent sodium hypochlorite disinfecting solution prior to installation.

D. Water mains under construction that become flooded by storm water, runoff, or ground water shall be cleaned by draining and flushing with metered potable water until clear water is evident. Upon completion, the entire main shall be disinfected using a method approved by the Engineer.

E. Unless authorized, disinfection shall commence not longer than 1 week after a successful hydrostatic test has been approved by the District Engineer.

3.02 METHODS.

A. Sodium Hypochlorite Solution (Liquid)

1. Sodium hypochlorite solution shall be used for cleaning and swabbing piping and appurtenances immediately prior to installation and for disinfecting all components of connections to the District's existing system.
2. Sodium hypochlorite solution may be used for the initial disinfection of newly installed water mains. The solution shall be applied at a terminus of the system to be chlorinated using an injector which can adjust the amount of solution being injected into the piping system. The solution shall be injected in the appropriate concentration to achieve the specified concentration range of chlorine throughout the entire piping system. Where pumping equipment is used in conjunction with an injector, an integral backflow prevention device shall be installed and connected to the potable water supply.
3. Pumping equipment, piping, appurtenances and all other equipment in contact with potable water shall be disinfected prior to use.
4. Calcium hypochlorite solution may also be used to increase the total chlorine residual if the concentration from the initial chlorination of the system is found to be low. The solution shall be added to the system in sufficient amounts at appropriate locations to insure that the disinfecting solution is present at a concentration within the specified range throughout the piping system.
5. Water trucks shall NOT be allowed for use in any process of disinfecting the

water.

3.03 PROCEDURE FOR DISINFECTING WATER MAINS AND APPURTENANCES.

A. The pipeline shall be filled at a rate not to exceed 300 GPM or a velocity of 1 foot per second, whichever is less.

B. Disinfection shall result in an initial total chlorine concentration of 150-mg/l. This concentration shall be evenly distributed throughout the system to be disinfected.

C. All valves shall be operated with the disinfection solution present in the pipeline. All appurtenances such as air-vacuum relief valves, blowoffs, hydrants, backflow prevention devices, and water service laterals shall be flushed with the treated water a sufficient length of time to insure a chlorine concentration within the specified range in all components of each appurtenance. (Note the limitations for discharge of chlorinated water outlined below.)

D. The Engineer will verify the presence of the disinfection solution throughout the system by sampling and testing for acceptable chlorine concentrations at the various appurtenances and/or at the test ports provided by the Contractor. Areas of the system found to be below the specified chlorine concentration level shall receive additional flushing as noted above and/or additional disinfection solution as necessary. (Note the limitations for discharge of chlorinated water outlined below.) Addition of disinfection solution after the initial charging of the line shall be made by either the liquid chlorine method, or the Calcium hypochlorite method as directed by the Engineer.

E. The chlorinated water shall be retained in the system for a minimum of twenty-four (24) hours. After the solution has remained in the piping system for twenty-four (24) hours, the District Engineer will test the total chlorine residual. A total chlorine residual of not less than 80% of the initial total chlorine residual must be maintained. If the total chlorine residual has decreased more than 20%, the system shall be flushed and re-disinfected and the solution maintained within the piping system for twenty-four (24) hours. Additional tests will be performed after the 24-hour period. If the total chlorine residual has not decreased more than 20% after this additional 24-hour period, the system shall be flushed in accordance with the procedure detailed herein. If the total chlorine residual has decreased more than 20% after the second test, the contractor shall prepare a written scope of work for the inspection of the pipeline for dirt, debris, or other foreign material within the pipe. Contractor shall provide District with satisfactory inspection reports including video, photos, or other documentation indicating that the interior of the pipe is free from any material that may impact pipeline disinfection. All costs including staff time, equipment, testing, and water used to flush and sample after the second chlorine residual testing will be the responsibility of the contractor.

F. Following a successful retention period as determined by the District Engineer, the high concentrated chlorinated water shall be drained from the system at its extremities and at each appurtenance. The highly concentrated chlorinated water shall be drained and de-chlorinated prior to entry to atmospheric conditions. The chemicals used to de-chlorinate the line shall be injected into the discharge piping prior to exiting the piping with sufficient distance to mix the de-chlorinating chemical with the high concentrated water. The District Engineer shall sample the water at various intervals to insure the neutralization of the chlorine.

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Following the successful de-chlorination of the highly concentrated water, the system shall be flushed at its extremities and at each appurtenance, using potable water from a source designated by the District Engineer. The minimum water velocity during flushing shall be 2.5 feet per second or as directed the District Engineer. Flushing shall continue until the replacement water in the new system is equal in chlorine residual to the potable source as verified by the District. (Note: See the limitations for discharge of chlorinated water outlined below.)

G. The District will perform bacteriological sampling and testing as specified herein.

3.04 DISCHARGE OF CHLORINATED WATER.

A. Indiscriminate onsite disposal or discharge to sewer systems, storm drains, drainage courses or surface waters is prohibited. It shall be the responsibility of the Developer to Discharges of Hydrostatic Test Water and Potable Water to Surface Waters, Storm Drains or Other Conveyance Systems, San Diego Region (Hydrostatic Test Permit) for any discharge of hydrostatic test water or other potable water. The Contractor shall be solely responsible to evaluate, obtain and comply with the provisions of the Hydrostatic Test Permit, including any monitoring and reporting as may be required. The Contractor shall comply with all requirements of the State Water Resources Control Board and the San Diego Regional Water Quality Control Board. The Contractor shall provide copies of all reports and monitoring information to the District.

B. Failure to comply with the Hydrostatic Test Permit is a violation of federal and state law. The Contractor hereby agrees to indemnify and hold harmless the District, its Board members, officers, agents, employees and authorized volunteers from and against any and all claims, demands, losses or liabilities of any kind or nature which District, its Board members, officers, agents, employees and authorized volunteers may sustain or incur for noncompliance with the Hydrostatic Test Permit arising out of or in connection with the Project.

C. The environment to which the chlorinated water is to be discharged shall be examined by the Developer and the Engineer. Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of chlorinated water. Any indication that the discharge of chlorinated water may cause damage to the environment shall require the neutralizing of the chlorine residual by means of a reducing agent in accordance with AWWA C651 and the requirements of this specification.

D. In locations where chlorine neutralization is required, the reducing agent shall be applied to the water as it exits the piping system. The Developer shall monitor the chlorine residual during the discharge operations. Total residual chlorine limits in these locations, and for the discharge of chlorinated water from the testing of pipelines to surface waters of the San Diego Region are as follows:

Total Residual Chlorine Effluent Limitations

30-Day Average	0.002mg/l
Average Daily Maximum	0.008 mg/l
Instantaneous Maximum	0.0 mg/l

The various methods of dechlorination available can remove residual chlorine to concentrations below standard analytical methods of detection, 0.02 mg/l, which will assure compliance with the effluent limit. The Developer will perform all necessary tests to ensure that the total residual chlorine effluent limitations listed above are met.

E. In locations where no hazard to the environment is evident based on the joint examination described above, the chlorinated water may be broadcast for dust control on the surface of the immediate site. Care shall be exercised in broadcasting the water to prevent runoff.

3.05 BACTERIOLOGICAL TESTING.

A. After disinfection final flushing and before the water main is placed in service, a sample or samples shall be collected from the pipeline and tested for bacteriological quality to demonstrate the absence of coliform organisms per AWWA C651 and as specified herein. Two consecutive sets of acceptable samples, taken at least 24-hours apart will be taken along the pipeline at a minimum of two separate locations. Sample locations will be determined in the field per the District Engineer. Samples of bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulphate. No hose or fire hydrant shall be used as a sampling station.

B. All samples shall be taken by District Staff during routine sampling each Monday. Samples taken on any other day will be at the contractor’s cost. The contractor shall provide a written request for District staff to take samples a minimum of forty-eight (48) hours prior to the requested date.

C. Contractor may flush and then re-sample a second time. If the second series of samples fail to produce passing results, then the contractor shall re-disinfect the line as stated earlier within these specifications and have samples taken. If the disinfection fails to produce satisfactory bacteriological test results, the Contractor may flush and then re-sample a fourth time. Should these samples fail to produce satisfactory results, the contractor shall prepare a written scope of work for the inspection of the pipeline for dirt, debris, or other foreign material within the pipe. Contractor shall provide District with satisfactory inspection reports including video, photos, or other documentation indicating that the interior of the pipe is free from any material that may impact pipeline disinfection and bacteriological testing. All costs including staff time, equipment, testing, and water used to flush and sample after the fourth

failed bacteriological testing will be the responsibility of the contractor.

D. Unless authorized, all connections must be completed within fourteen (14) days from receipt of acceptable bacteriological test results. Should connections occur after fourteen (14) days, the contractor shall flush the piping system as outlined within these specifications? Should connections occur after twenty (20) days, the contractor shall re-disinfect the piping system as outlined within these specifications.

E. Pipes, fittings, valves and all other components incorporated into connections with the District's existing system shall be spray disinfected or swabbed with a liquid chlorine solution in accordance with AWWA C651 and as specified herein. Upon connection to the main, the line shall be flushed as directed by the District Engineer. Disinfection by this method is generally limited to assemblies of twenty (20) feet or less in length. Alternate methods such as "predisinfection" prior to installation in accordance with AAWA C651 may be allowed at the discretion of the District Engineer.

END OF SECTION 15041