SECTION 02666 - WATER PIPELINE TESTING AND DISINFECTION

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes flushing and testing of all pressure pipelines and appurtenant piping for [reclaimed water] [potable water] and disinfection of all pipelines and appurtenant piping for [reclaimed] [potable] water, complete, including providing test water and all disposal thereof.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 01560 Environmental Protection
2. Section 02667 Testing and Disinfection of Hydraulic Structures

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SPECIFICATIONS AND STANDARDS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

1.	ANSI/AWWA B300	Hypochlorites
2.	ANSI/AWWA B301	Liquid Chlorine
3.	ANSI/AWWA C651	Disinfecting Water Mains
4.	APHA, AWWA, and WEF	Standard methods for the Examination of Water and Wastewater

1.5 TESTING SCHEDULE

A. The following shall be submitted:

1. A testing schedule, including proposed plans for water conveyance, control, and disinfection shall be submitted in writing for approval a minimum of 48 hours before testing is to start. The submittal shall also include the CONTRACTOR'S plan for the release of water from pipelines after testing and disinfection has been completed.

PART 2 -- PRODUCTS

2.1 MATERIALS REQUIREMENTS

A. All test equipment, chemicals for chlorination, temporary valves, temporary blow-offs, bulkheads, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR. No materials shall be used which would be injurious to the pipeline or its future function.

B. Chlorine for disinfection shall be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.

C. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301. Liquid chlorine shall be used only:

1. In combination with appropriate gas flow chlorinators and ejectors;

2. Under the direct supervision of an experienced technician;

3. When appropriate safety practices are observed.

D. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300.

PART 3 -- EXECUTION

3.1 GENERAL

A. Unless otherwise indicated, potable water for testing and disinfecting water pipelines will be furnished by the CONTRACTOR. The CONTRACTOR shall also make all necessary arrangements for conveying the water to the points of use.

B. All pressure pipelines shall be tested. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be performed in the presence of the CONSTRUCTION MANAGER.

C. Disinfection operations shall be scheduled by the CONTRACTOR as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities at the time the WORK is accepted by the OWNER.

3.2 HYDROSTATIC TESTING OF PIPELINES

A. Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. The CONTRACTOR shall test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. The CONTRACTOR shall provide sufficient temporary air tappings in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. After

completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open during filling.

B. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the CONSTRUCTION MANAGER shall be taken.

C. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 4 hours. The test pressure for distribution and transmission pipelines shall be 133 percent of the pipe pressure class indicated measured at the lowest point of the pipeline section being tested. The test pressure for yard piping shall be as indicated on the Piping Schedule measured at the lowest point of the pipeline section being tested. No pressure test will be required for a reservoir overflow line. All visible leaks shall be repaired in a manner acceptable to the CONSTRUCTION MANAGER.

D. The maximum allowable leakage for distribution and transmission pipelines shall be [10] U.S. gallons per inch of diameter per mile of pipe per 24 hours for pipe with 40-ft or greater lengths between joints and with rubber-gasketed joints and [20] U.S. gallons per inch of diameter per mile of pipe per 24 hours for pipe with 20-ft or less lengths between joints and with rubber-gasketed joints. The maximum leakage for yard piping shall be as shown on the Piping Schedule. Pipe with welded joints shall have no leakage. In the case of pipelines that fail to pass the prescribed leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines.

3.3 DISINFECTING PIPELINES

A. **General:** All potable water pipelines except those appurtenant to hydraulic structures shall be disinfected in accordance with the requirements of ANSI/AWWA C651 using the Continuous-Feed Method as modified herein. Preliminary and final flushing shall be done at the ends of mains which have been hydrostatically tested.

B. **Chlorination:** A chlorine-water mixture shall be uniformly introduced into the pipeline by means of a solution-feed chlorinating device. The chlorine solution shall be introduced at one end of the pipeline through a tap in such a manner that as the pipeline is filled with water, the dosage applied to the water entering the pipe shall be approximately 50 mg/l. Care shall be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.

C. **Chlorine Residual Test:** The OWNER will make 24-hour chlorine residual tests. The OWNER will notify the CONTRACTOR of the chlorine test result. Chlorinated water shall be retained in the pipeline for at least 24 hours. After the chlorine-treated water has been retained for the required time, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 25 mg/l.

D. **Repetition of Test:** The disinfection testing procedure shall be repeated if the initial tests fail to produce satisfactory results. Two consecutive satisfactory test results shall be required after any unsatisfactory test. The tablet method shall not be used for repeated disinfection.

E. **Chlorinating Valves:** During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily-chlorinated water.

F. **Final Flushing:** Final Flushing shall be done by the CONTRACTOR after he has been notified of a satisfactory chlorine residual test by the OWNER. After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for the intended use. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize thoroughly the chlorine residual remaining in the water at no additional cost to the OWNER.

G. **Disinfection of Connections:** Pipe and appurtenances used to connect the newly installed water main shall also be disinfected in accordance with AWWA C651.

H. **Neutralization of Chlorinated Water:** Neutralizing and disposing of chlorinated water shall be in accordance with Appendix "B" of AWWA Standard C651.

3.4 BACTERIOLOGICAL TESTING OF DISINFECTED PIPELINES

A. The CONSTRUCTION MANAGER will collect 2 sets of samples at least 24 hours apart after completion of final flushing as indicated above. Samples will be taken at locations indicated in ANSI/AWWA C651 and will be tested for coliform organisms and standard plate count according to the latest edition of the Standard Methods for the Examination of Water and Wastewater. Laboratory costs of initial testing will be the OWNER's responsibility.

B. If disinfection fails to produce satisfactory bacteriological counts, the pipe shall be reflushed and will be resampled and retested. If counts from analysis of the second samples exceed the criteria in Standard methods, the pipe shall be re-disinfected and will be resampled and retested until satisfactory results are obtained. The CONTRACTOR shall be responsible for all repeat bacteriological testing costs.

** END OF SECTION **