

41-2.15 DISINFECTION OF WATER MAINS

Any of the methods stated in AWWA Standard C651 are accepted as a means of disinfection of water mains.

41-2.15A FLUSHING

Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, then a tap should be provided large enough to develop a velocity of at least two and five-tenths (2.5) feet per second (0.762 meter per second) in the main. A two and one-half (2 1/2) inch (63.5 mm) hydrant opening will, under normal pressures, provide this velocity in pipe sizes up to and including twelve (12) inches (305 mm).

All taps two (2) inch (51 mm) in size and smaller required for chlorination or flushing purposes, or for temporary or permanent release of air, shall be provided by the CONTRACTOR as a part of the construction of water mains. Taps larger than two (2) inch (51 mm) shall be paid for as a bid item or as Extra Work.

41-2.15B REQUIREMENT OF CHLORINE

Before being placed into service, all new mains and repaired portions of, or extensions to, existing mains shall be chlorinated so that the initial chlorine residual is not less than fifty (50) mg/L and that a chlorine residual of not less than twenty-five (25) mg/L remains in the water after standing twenty-four (24) hours in the pipe.

See Article 7-12 "Use of Fire Hydrants" regarding use of water for flushing and disinfection.

41-2.15C FORM OF APPLIED CHLORINE

Chlorine shall be applied by one of the methods that follow subject to approval by the ENGINEER.

(1) LIQUID CHLORINE

A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device, or the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas, or the gas itself, must provide means for preventing the backflow of water into the chlorine.

(2) CHLORINE-BEARING COMPOUNDS IN WATER

A mixture of water and high-test calcium hypochlorite (65-70% Chlorine) may be substituted for the chlorine gas water mixture. The dry powder shall first be mixed as a paste and then thinned to a one (1) percent chlorine solution by adding water to give a total quantity of seven and five-tenths (7.5) gallons of water per pound (62.5 liters of water per kg) of dry powder. This solution shall be injected in one end of the section of main to be disinfected while filling the main with water in the amounts as shown in the table which follows:

**CHLORINE REQUIREMENTS TO PRODUCE 50 MG/L
CONCENTRATION IN 100 FOOT OF PIPE - BY DIAMETER**

Pipe Size Inches	100% Chlorine, Lb.	1% Chlorine Solution, Gals
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

**CHLORINE REQUIREMENTS TO PRODUCE 50 MG/L
CONCENTRATION IN 10 METERS OF PIPE - BY DIAMETER**

Pipe Size Milimeters	100% Chlorine, Grams	1% Chlorine Solution, Liters
100	3.9	0.39
150	8.8	0.88
200	15.7	1.57
250	24.5	2.45
300	35.3	3.53

(3) TABLET DISINFECTION

Tablet disinfection is best suited to short extensions (up to 2500 ft.) (762 meters) and smaller diameter mains (up to 12 inch) (300 mm). Since preliminary flushing must be eliminated in using this method, it should be utilized only when scrupulous cleanliness has been used in construction. It shall not be used if trench water or foreign material has entered the main or if the water is below 41° F (5° C).

Tablets should be placed in each section of pipe, hydrants, hydrant branches, and other appurtenances. Tablets must be at the top of the main and shall be attached by an adhesive, such as Prematex No 1 or any alternative approved by the ENGINEER. Tablets in joints between pipe sections, hydrants, hydrant branches, and appurtenances are to be crushed and placed inside the annular space or rubbed like chalk in butt ends of sections to coat them if the type of assembly does not permit crushing.

In filling a section of piping with water when using the tablet method, water velocity shall be less than one (1) foot per second (0.30 meters per second).

**NUMBER OF 5-GRAM HYPOCHLORITE TABLETS REQUIRED
FOR A DOSAGE OF 50 MG/L PER LENGTH OF PIPE SECTION**

Pipe Size in Inches (millimeters)	Length of Pipe Section in Feet (meters)				
	Up to 13 (4 m)	18 (5.5 m)	20 (6.1 m)	30 (9.15 m)	40 (12.2 m)
2(50mm)	1	1	1	1	1
4(100mm)	1	1	2	2	2
6(150mm)	2	2	3	3	4
8(200mm)	2	3	3	5	6
10(250mm)	3	5	5	7	9
12 (300mm)	5	6	7	10	14

41-2.15D POINT OF APPLICATION

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipe line extension. Alternate points of application may be used when approved or directed by the ENGINEER.

41-2.15E PREVENTING REVERSE FLOW

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves may be used if desired.

41-2.15F RETENTION PERIOD

Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least twenty-five (25) mg/L.

41-2.15G CHLORINATING VALVES AND HYDRANTS

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent and under normal operating pressure.

41-2.15H FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows upon test a chlorine residual of less than 1 mg/L. In the event chlorine is normally used in the source of supply, then the tests shall show a residual not in excess of that carried in the system.

All water mains must be shown to be free of bacterial growth as measured by the membrane filter technique or no tubes positive as measured by presumptive test, fermentation tube method before being placed into service. Representative samples shall be collected at locations as directed

by the ENGINEER. All samples shall be analyzed for bacteriological contamination at a laboratory certified by Illinois Department of Public Health.

Satisfactory disinfection is demonstrated when two consecutive water samples, collected at least twenty-four (24) hours apart, indicate no bacterial contamination.

The requirement for two consecutive samples at representative locations may be modified at existing community water supplies which practice chlorination and which maintain adequate chlorine residual at the point of connection to the new water main. For such situations, satisfactory disinfection is demonstrated by a single sample set which shows no bacterial contamination.

41-2.15I REPETITION OF FLUSHING AND TESTING

Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained on successive samples taken at least twenty-four (24) hours apart.

41-3 MEASUREMENT

In addition to the items listed for separate measurement and payment in Section 20, 21 and 24 the following items will be measured for payment when required for water main construction:

(1) WATER MAIN

Water main shall be listed in the bid items by size and type, and shall be measured in feet (meter), slope measurement, along the center line without deduction for valves and fittings. However, when the water main terminates in a hydrant valve or other main connection, measurement shall be from the center of the hydrant valve or other main connection.

(2) GATE VALVES AND VALVE BOXES OR VAULTS

Gate valves and valve boxes of the size required shall be measured for payment as an installed unit.

(3) CAST OR DUCTILE IRON FITTINGS

Cast or Ductile Iron fittings shall be measured for payment by the pound (kg). The weight of accessories shall be included as part of the weight of the fittings. Shipper's invoice weight shall be taken as the weight for payment purposes, subject to confirmation by actual weighing near the site if there is reason to doubt the accuracy of invoice weights.

(4) SERVICE PIPE

Service pipe of the size and type required shall be measured in feet (meter) for installed length.

(5) FIRE HYDRANTS

Fire hydrants by size and type required shall be measured for payment as an installed unit complete with accessories and thrust blocking. Where a gate valve is required on the connection between the water main and the fire hydrant, the gate valve shall not be included with the payment for fire hydrant but shall be measured for separate payment.

(6) SERVICE METERS COMPLETE

Service meters of the size and type and with the auxiliary equipment described in the Special Provisions and shown on the Plans shall be measured as an installed unit complete in place,