ITEM 940

DISINFECTION OF WATER MAINS

940.1 General

This item governs for disinfection of new and repaired water lines by application of sterilizing agent into water used for initial filling per AWWA C651 and as described below. All new water lines or water lines taken out of service for inspecting, repairing, wet connections, installation of tapping sleeves/crosses, or other activity that might lead to contamination of potable water must be disinfected before being put into, or returned to, service.

940.2 Disinfectant Agent

Use calcium hypochlorite tablets or granules per AWWA B300.

940.3 Prevention and Corrective Measures

Keep interiors of pipe, fittings, valves, and appurtenances clean and dry during storage and installation. Close all pipe system openings with appropriate watertight plugs when construction is suspended for any length of time. If water, or other material, accumulates in trench, plugs are to remain in place until trench is clean and dry. Avoid contamination of sealing material or gaskets. If dirt enters pipe and cannot be removed by flushing operation, clean interior of pipe by mechanical means and then swabbed with a one percent (1%) hypochlorite disinfecting solution. Perform cleaning with a pig, swag, or "go-devil" only if determined that such operation will not force mud or debris into pipe joint spaces.

940.4 Disinfection Procedure

Consists of placing calcium hypochlorite tablets or granules in water main as it is being installed and filling main with potable water when installation is completed. This method may be used only if pipes and appurtenances are kept clean and dry during construction. The amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million.

WARNING: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

A. Placing of calcium hypochlorite granules: During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules shall be as shown in Table 1.

B. Placing of Calcium Hypochlorite Tablets: During construction, 5-g calcium hypochlorite tablets to be placed in each section of pipe and

also one such tablet to be placed in each hydrant, hydrant branch, and other appurtenance. Number of 5-g tablets required for each pipe section to be 0.0012 d2L rounded to the next higher integer, where d is inside pipe diameter in inches, and L is length of the pipe section in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. Tablets to be attached by a food-grade adhesive.* No adhesive to be on tablet except on the broad side attached to the surface of pipe. Attach all tablets inside and at top of main, with approximately equal numbers of tablets at each end of a given pipe length. If tablets are attached before the pipe section is placed in trench, mark their position on pipe section so it can be readily determined that pipe is installed with tablets at top.

C. Filling and Contact: When installation has been completed, fill main with water at a rate such that water within main will flow at a velocity no greater than 1 ft/sec. Take precautions to assure that air pockets are eliminated. Strong chlorine water solution to remain in pipe for at least 24 hrs. If water temperature is less than 41°F (5°C), water to remain in pipe for at least 48 hrs. Close valves so that strong chlorine water solution in treated main will not flow into existing water mains in active service.

Table 1
Ounces of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft interval

Pipe Diameter		Calcium Hypochlorite Granules	
in	(mm)	oz	(g)
4	(100)	0.5	(14)
6	(150)	1.0	(28)
8	(200)	2.0	(57)
12	(250)	4.0	(113)
16 and larger	(400 and larger)	8.0	(227)

*Examples of food-grade adhesives are Permatex Form-A-Gasket No. 2 and Permatex Clear RTV Silicone Adhesive Sealant, which are manufactured by Loctite Corporation, Kansas City, KS 66115. These products have both been approved by USDA for uses that may contact edible products. Neither product has been approved in accordance with NSF Standard 61. Other company products, such as Permatex Form-A-Gasket No. 1, have not received FDA approval.

Table 2
Number of 5-g Calcium Hypochlorite Tablets Required for Dose of 25 mg/L*

Pipe Diameter	Length of Pipe Section, ft				
	13 or less	18	20	30	40
in	Number of 5-g Calcium Hypochlorite Tablets				

4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

*Based on 3.25 g available chlorine per tablet; any portion of tablet rounded to next higher number.

940.5 Final Flushing

A. Flushing Main: After retention period, heavily chlorinated water shall not be permitted to remain in prolonged contact with pipe. In order to prevent damage to pipe lining or corrosive damage to pipe itself, flush heavily chlorinated water from main until chlorine measurements show that concentration in water leaving main is no higher than that generally prevailing in system or is acceptable for domestic use.

B. Disposing of Heavily Chlorinated Water: Inspect environment into which chlorinated water will be discharged. If any question that chlorinated discharge will cause damage to environment, then apply a reducing agent to the water to be wasted in order to neutralize thoroughly chlorine residual remaining. Where necessary, contact federal, state, and local regulatory agencies to determine special provisions for disposal of heavily chlorinated water.

940.6 Bacteriological Tests

A. Standard Conditions: After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1200 ft (366m) of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with Standard Methods for Examination of Water and Wastewater, and shall show the absence of coliform organisms. A standard heterotrophic plate count may be required at the option of the purchaser (or purchaser's representative).

B. Special Conditions: If trench water has entered the new main during construction or, if in the opinion of the purchaser (or purchaser's representative), excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft (61m) and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.

C. Sampling Procedure: Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods for the Examination of Water and Wastewater. No hose or fire hydrant shall be used in the collection of samples. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for use.

D. If initial disinfections fail to produce satisfactory bacteriological results, the new main may be reflushed and shall be resampled. If check samples also fail to produce acceptable result, the main shall be rechlorinated by the continuous-feed or slug method of chlorination until satisfactory result is obtained.

940.7 Disinfection for Cutting into or Repairing Existing Mains

Following procedures apply primarily when existing mains are wholly or partially dewatered. After appropriate procedures have been completed, main may be returned to service prior to completion of bacteriological testing in order to minimize time customers are out of water. Leaks or breaks that are repaired with clamping devices while mains remain full of pressurized water present little danger of contamination and require no disinfection.

A. Trench Treatment: When an old main is opened, apply liberal quantities of calcium hypochlorite granules and tablets to open trench area. Use tablets in open trench area, as they dissolve slowly and continue to release hypochlorite as water is pumped from excavation, and use granules on piping components.

B. Swabbing with Hypochlorite Solution: Interiors of all pipe and fittings (particularly couplings and sleeves) used in making repairs/connections to be swabbed or sprayed with a one percent hypochlorite solution before installations.

C. Flushing: Thoroughly flush to remove contamination introduced during repairs/connections. If valve and hydrant locations permit, flush toward work location from both directions. Flushing to start as soon as repairs/connections are completed and continue until discolored water is eliminated.

D. Disinfection: Where practical, in addition to procedures above, a section of main in which break is located to be isolated, all service connections shut off, and the section flushed and chlorinated by the slug method described in AWWA C651, except that dose may be increased to as much as 300 mg/L and contact time reduced to as little as 15 min. After chlorination, flushing to resume and continued until discolored water is eliminated and water is free of noticeable chlorine odor.

E. Sampling: Take bacteriological samples after repairs/connections are completed to provide a record for determining procedure's effectiveness. If direction of flow is unknown, take samples on each side of repair/connection. If positive bacteriological samples are recorded, situation to be evaluated by a qualified engineer who can determine corrective action, and daily sampling to continue until two consecutive negative samples are recorded.

940.8 Tapping Sleeve Connections

Before a tapping sleeve is installed, thoroughly clean exterior of main to be tapped, and lightly dust interior surface of sleeve with calcium hypochlorite granules. The space between the tapping sleeve and tapped pipe is normally ½ inch, more or less, thus, as little as 100 mg of calcium hypochlorite powder per square foot will provide a chlorine concentration of over 50 mg/L.

940.9 Measurement and Payment

No separate measurement and payment for work performed under this Item. Include cost of this work in Contract prices bid for Bid Items of which it is a component, unless otherwise specified in Bid Form.

END ITEM 940