SECTION 02455
DISINFECTION OF WATERLINES

PART I: GENERAL

1.1 GENERAL REQUIREMENTS
- A. Disinfection of potable water lines.

1.2 MEASUREMENT AND PAYMENT
- A. Unit Prices:
  1. No separate payment shall be made for disinfection of water lines under this Section. Include cost in the unit price of water lines being disinfected.
  2. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Payment for Testing and Retesting.
  1. Subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction shall be charged to the Contractor for each additional Bacterial Test.
  2. Charge shall consist of base charge of eighteen dollars ($18.00) per sample.
- C. Stipulated Price (Lump Sum):
  1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES
- A. AWWA – American Water Works Association.
  1. AWWA B300 – Hypochlorites.
  2. AWWA B301 – Standard for Disinfecting Water Mains.
  3. AWWA C651 – Standard for Disinfecting Water Mains.
- B. CFTS – City of Friendswood Technical Specifications.
- C. TCEQ – Texas Commission on Environmental Quality
  1. TCEQ – Approved Disinfection Methods and Products.

PART II: PRODUCTS

A. Liquid Chlorine (gas) conforming to AWWA B301.

B. Sodium Hypochlorite conforming to AWWA B300.

C. Calcium Hypochlorite conforming to AWWA B300.

PART III: EXECUTION

3.1 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before bacteriological tests are conducted on water lines and before water lines are connected to the City water distribution system.

B. Water for disinfection and flushing shall be furnished by the City without charge.

C. Unless otherwise provided in the Contract Documents, the Contractor shall be responsible for disinfection of water lines.

D. Coordinate chlorination operations through the Project Manager. A minimum of forty-eight hours (48 Hrs.) notice shall be given.

3.2 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials and other items needed to facilitate disinfection of new water lines prior to connection to the City water distribution system. Normally, each valved section of water line requires two (2) each three-quarter inch (3/4 In) taps. A two inch (2 In) minimum blow-off is required for water lines up to and including six inch (6 In) diameter.

B. Use fire hydrants as blow-offs to flush newly constructed water lines eight inch (8 In) diameters and above. Where fire hydrants are not available on newly constructed water lines, install temporary blow-off valves within ten feet (10 Ft.) of charging end and any dead end, and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by the Project Manager.

1. For lines chlorinated with calcium hypochlorite (granular or tablet form) the average water velocity when filling pipeline should be less than one foot per second (1 ft./sec) and shall not, under any circumstance, exceed two feet per second (2 ft./sec). Before beginning disinfection operations, expel air from pipeline.

2. For lines chlorinated with either Liquid chlorine or sodium hypochlorite the average water velocity when filling pipeline should be less than three foot per second (3 ft./sec) as shown in Table 4.3 – Flow Rates and Openings. Where such flow rates are not possible, flushing the maximum expected flow rate for two to three (2-3) volumes of waterline may be acceptable. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to the Drawings.

3.3 DISINFECTION BY THE CONTRACTOR

A. The following procedure shall be used when disinfection by the Contractor is required by the Contract Documents:

1. Use not less than one hundred parts of chlorine (100 CL) per million parts of water (1,000,000 H_2O).
2. Introduce chlorinating material to water lines in accordance with AWWA B300, AWWA B301, and AWWA C651. When using chlorine gas or sodium hypochlorite, chemicals shall be introduced into system at a point no farther than ten feet (10 Ft.) downstream of the beginning of the new water main. Calcium Hypochlorite materials shall be used in the quantities listed in Table 4.1 – Calcium Hypochlorite Granules Installation and Table 4.2 – Calcium Hypochlorite Tablets Installation.
3. After line has been charged with water, a chlorine test shall be taken and must be a minimum twenty-five parts free chlorine (25.0 CL) per million parts of water (1,000,000 H_2O) or greater for disinfection. After this level has been achieved, water shall stay in contact for a minimum of twenty-four hours (24 Hrs.). During this period all valves and fire hydrants shall be fully open and closed at least twice; once at the beginning and once at the end of the twenty-four hour (24 Hr.) period.
4. After contact period of twenty-four hours (24 Hrs.) a free chlorine residual test shall be taken and shall not be less than:
    a. two-tenths parts free chlorine (0.2 CL) per million parts of water (1,000,000 H_2O) for calcium hypochlorite. If the residual is less than two-tenths parts free chlorine (0.2 CL) per million parts of water (1,000,000 H_2O), then re-chlorinate the system starting over from 3.3.A.1; or
    b. ten parts free chlorine (10.0 CL) per million parts of water (1,000,000 H_2O) for calcium hypochlorite. If the residual is less than ten parts free chlorine (10.0 CL) per million parts of water (1,000,000 H_2O), then re-chlorinate the system starting over from 3.3.A.1; and
    c. if the residual passes then flush system with clean water using Fire Hydrants and approved blow-offs until chlorine is no less than two-tenths part of free chlorine (0.2 CL) per million parts of water (1,000,000 H_2O) or five-tenths part of total chlorine (0.5 CL) per million parts of water (1,000,000 H_2O) and not greater than three and nine-tenths parts free or total chlorine (3.9 CL) per million parts of water (1,000,000 H_2O).
5. Flush duration shall be until the furthest flushing outlet from the City water supply reaches the conditions of 3.3.A.4 and Table 4.3 – Flow Rates and Openings.
6. Open and close valves in lines being sterilized several times during contact period.
7. If chemical compound is used for sterilizing agent, place in pipes as directed by the Project Manager.

3.4 BACTERIOLOGICAL TESTING

A. All Bacteriological Testing shall be in accordance with Technical Specification 02465 – Procedure For Sampling Bacteriological Tests (BAC-T).

PART IV: TABLES

4.1 Calcium Hypochlorite Granules Installation:

A. Weight of calcium hypochlorite granules to be placed at the beginning of the main and at each 500 foot interval.

Pipe Diameter	Calcium Hypochlorite Granules
4”	1.7 oz.
6”	3.8 oz.
8”	6.7 oz.
10”	10.5 oz.
12”	1.5 oz.
14” and larger	D^2 x 1.5 oz.
Where D is the inside pipe diameter in feet, D= d/12.	

4.2 Calcium Hypochlorite Tablets Installation:

A. Number of 5 gram calcium hypochlorite tablets requires for dose of 25 ppm based on 3.25 grams available chlorine per tablet.

Pipe Diameter	Number of 5 gram tablets per length of pipe				
	13’ length or less	18’ length	20’ length	30’ length	40’ length
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	11

4.3 Flow Rates and Openings:

A. Required flow rates and openings to flush pipelines at 3.0 ft. /sec.

Number of 5 gram tablets per length of pipe						
Pipe Diameter	Velocity in (gpm)	Size of taps used / number taps required			Number of Hydrant Outlets	
		1”	1 ½”	2”	2 ½”	4 ½”
4”	120	1	–	–	1	1
6”	260	–	1	–	1	1
8”	470	–	2	–	1	1
10”	730	–	3	2	1	1
12”	1,060	–	–	3	2	1
16”	1,880	–	–	5	3	1

END OF SECTION