

STANDARD SPECIFICATIONS  
SECTION 02512  
CLEANING AND LINING WATER MAINS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Section includes requirements for cleaning and lining existing cast iron and ductile iron water mains of various sizes following Contract Documents.

1.2 QUALITY ASSURANCE

- A. Pipe, fittings, and valves: Meet requirements of Section 02510.
- B. Cleaning and Lining.
1. Guarantee to restore cleaned and cement-mortar lined water mains to following minimum Hazen-Williams C Factor ( $C_{hw}$ ) based on nominal pipe diameters with proper allowance being made for bends and fittings following accepted practice:

NOMINAL PIPE DIAMETER	GUARANTEED HAZEN-WILLIAMS $C_{hw}$ FACTOR
3 inch and smaller	90
4 inch	90
6 inch	100
8 inch	110
10 inch	115
12 inch	120
14 inch	125
16 inch	125
20 inch	125
Above 20 inch	130

1.3 SUBMITTALS

- A. Submit following Section 01330.
1. Temporary bypass water service system following Section 02510.
  2. Method of covering access excavations during non-working periods.
  3. Proposed method for disposal of debris and water used for cleaning.
  4. Cement mortar lining mix data including dry weights of cement; sand; admixture name, type and quantity, if used; volume of water per cubic yard.
- B. Submit Certificate of Compliance following Section 01450 for following materials:
1. Sand.
  2. Cement.

- a. Include certification that facility where cement was produced complies with ANSI/NSF Standard 61.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Ship cement to Contract site in full sacks and store so it is kept dry. Do not use cement from broken sacks for lining operations.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Pipe and Fittings: Following Section 02510.
- B. Temporary Bypass System:
  1. Temporary bypass and fire hydrant piping to maintain water service and fire protection.
  2. Check valves 3 inches to 10 inches in diameter for temporary installation during disinfection.
  3. Notched meter covers for temporary use when temporary piping is in service.
  4. Clear plastic bags for hanging of meters.
- C. Cleaning and Lining: AWWA C602 except as modified herein.
  1. Sand: ASTM C144 and kept clean and free of foreign materials during transportation and storage on site.
  2. Cement: Type II, manufactured at facility certified for compliance with ANSI/NSF Standard 61, and in sacks bearing NSF approval stamp.
  3. Proportions of cement and sand in mortar: 1 part cement to 1 part sand.
- D. Equipment.
  1. Cleaning.
    - a. Drag cleaning, hydraulic jet, abrasive pig, metal scraping, or power boring type. Knocker type not allowed.
  2. For placing cement mortar lining:
    - a. Applicator head that in one course centrifugally projects mortar against surface of pipe sections and long radius bends, without injurious rebound, and with sufficient velocity to cause mortar to be densely packed and to adhere in place.
      - 1) Rate of travel of machine and rate of discharge of mortar against wall of pipe: Entirely mechanically controlled to produce smooth, uniform thickness of lining throughout interior of pipe.
      - 2) Attachment with rotating or drag steel trowels follows applicator head and trowels cement mortar lining to a smooth, hard surface of uniform thickness.
      - 3) Operation of trowels: Continuous during application of cement mortar and forward movement of applicator head.
      - 4) Machine.

- a) Moves ahead of lining so nothing comes in contact with troweled surface until it has attained its final set.
- b) Control of forward movement and mechanical placing of mortar: Assure uniform thickness of mortar lining following AWWA C602.

## PART 3 EXECUTION

### 3.1 WORK PERFORMED BY THE COMMISSION

- A. Shutdowns: See Section 02510.
- B. Notify all property owners in advance of work.
- C. Notify Customer Care Team when Contractor is removing and reinstalling meters for temporary by-pass system.
- D. Take and analyze water samples: See Section 02510.

### 3.2 PREPARATION

- A. Temporary Bypass Water Service System.
  - 1. Follow Section 02510 and specified herein.
    - a. Provide check valves 3 inches to 10 inches in diameter as close as possible to existing water source, for temporary installation during disinfection as approved by Engineer.
    - b. Do not install bypass between November 15 and March 1 in any calendar year.
- B. Access Openings.
  - 1. Provide access at locations required to complete Work and approved by Engineer.
  - 2. Excavate, provide sheeting and shoring, dewater, and backfill following Section 02315.
  - 3. Provide sediment control following Section 01570.
  - 4. Make access openings for pipe with space to admit and withdraw equipment with least delay and without causing damage to existing pipe.
  - 5. After shutdown, dewater pipe and drain low spots. Provide measures as required to prevent water from entering work sections and maintain dry condition.
  - 6. Remove pipe at access points by cutting with power operated pipe cutting machines, capable of making fast, true and smooth cuts so valves or pipe sections removed may be replaced in true alignment.
    - a. Where difficulties due to obstructions make it impossible to use preceding method of cutting pipe, other methods may be used provided they meet Engineer's approval and same results are attained with no additional cost to the Commission.
  - 7. Measure outside diameter of cut pipes to properly determine class of pipe in each cut.

- a. Class of pipe will determine proper sized sleeves or couplings to be used in reconnection.
- 8. Replace exposed lead or poured joints with mechanical joint fittings or couplings at Engineer's direction.

### 3.3 CLEANING AND LINING

#### A. Perform cleaning and lining: Following AWWA C602 and specified herein.

- 1. Cleaning.
  - a. Clean interior surfaces of pipe and fittings to be lined by machine where practicable and by hand where access by machine is not possible.
  - b. Remove obstructions in pipeline that prohibit passage of cleaning or lining equipment.
  - c. Remove loose scale, tuberculation, oil, grease, remains of old coating materials, and accumulations of debris.
  - d. Remove accumulations of water on bottom of interior of pipe.
  - e. Handle cleaning water in closed discharge hoses to prevent water and residue from causing damage.
  - f. Dispose of residue from cleaning and other construction operations as well as water from dewatering operations, in a manner satisfactory to Engineer and authority having jurisdiction over area where work site is located.
  - g. Filter solids-laden water through an approved desilting device.
- 2. Lining.
  - a. Place lining with machines in 1 course specified herein.
  - b. Thickness of cement mortar lining: Uniform and follow AWWA C602.
  - c. Nominal lining thickness for old and new gray cast iron and ductile iron:

<u>Pipe Diameter, in.</u>	<u>Lining Thickness, in.</u>	<u>Tolerance, in.</u>
4-10	3/16	-1/16, +1/8
12-20	1/4	-1/16, +1/8
24-36	5/16	-1/16, +1/8
>36	5/16	-1/16, +3/16

- d. Correct lining not within this tolerance at Engineer's direction.
- e. Place cement mortar lining so as not to seal or otherwise reduce effectiveness of existing air valves and blowoffs.
- f. Perform cement mortar lining of sharp bends, fittings, and areas closely adjacent to valves or other points where machine access is impossible or impractical and correct defective areas by hand.
- g. Hand mortar work: Equal to machine placed work and use same materials.
  - 1) If necessary, moisten pipe prior to placement of mortar.
  - 2) Use steel trowels except where curvature of bends prohibit their use.
  - 3) Complete handwork in section of pipeline within 24 hours after machine work in that section is complete.
  - 4) Provide smooth transition from handwork to machine-placed mortar.
- h. Remove bends, fittings and pipe that cannot be lined by hand. Provide new bends, fittings and pipe.

- i. Feather edges between newly lined areas and unlined areas.
- j. Clean and line mains up to side valves and sections of pipe removed for access.
- k. Remove cleaning debris and lining material from existing service connections on lined main.
  - 1) Clear service connections that are 2-inch or less in diameter and on pipes less than 24-inch diameter by backflushing with air or water within 2 hours of placing lining.
  - 2) On pipes 24-inch and larger, temporarily plug or cover service connections prior to lining, and remove plugs or covers after lining.
    - a) Service connections may be flushed with Engineer's prior approval.
  - 3) Do not damage lining when clearing service connections.
  - 4) Use in-house valve to blow back if curb stop is inoperable.
- l. Immediately after completing lining of length of pipe between access openings or at end of day's run, close that section of pipe at each end and cover access openings to prevent circulation of air to maintain moist condition.
- m. With Engineer's approval, 24 hours after placing lining, fill section between bulkheads or gate valves with system water for curing lining.
- n. Cure pipe lining for minimum of 48 hours before recharging and disinfecting.

**B. Disinfection.**

- 1. Before newly lined water main sections are disinfected, perform following:
  - a. Reinstall sections of pipe removed for access or install valves as approved by Engineer to include replacement of lead or poured joints when directed.
  - b. Install fittings and mechanical couplings as required so that there is no visible leakage.
  - c. Coat scarred exterior surfaces of pipe and fittings, and coat exterior surfaces of mechanical couplings, including bolts and nuts, following Section 02510.
  - d. New pipe, fittings, and valves installed in existing mains: Clean and spray or swab with minimum 1 percent solution of chlorine just before installation.
  - e. Provide corporation stops in water mains for disinfection.
  - f. Provide new taps as required for water house connections following Section 02510.
  - g. Provide means to flush.
  - h. Replace lined-through valves with new valves.
  - i. Provide temporary check valves between cleaned and uncleaned pipe for disinfection purposes.
- 2. To disinfect, introduce distribution system water to cleaned and lined mains.
  - a. Testing of water from cleaned and lined water mains: Same as for temporary bypass system.
- 3. Discharge of Chlorinated Water: See Section 02511.

**C. Returning Lined Main to Service.**

- 1. When disinfection is completed and line is approved for service, Engineer will notify Contractor to restore line to service.
  - a. Remove corporation stops used for disinfection and install plugs.

- b. Coat plug assemblies.
  - c. After pipe access openings are closed and before backfill, fully recharge main and eliminate visible leakage.
2. After approval of Engineer.
    - a. Backfill excavated areas.
    - b. Reactivate house connections and remove temporary bypass piping system.
    - c. Reinstall removed meters at same location from which they were removed with water flow in correct direction and using new gaskets compatible with meter.
  3. After permanent service is restored and temporary bypass piping is removed, restore disturbed areas.
    - a. Seed and sod following Section 02920.
    - b. Restore pavement following Section 02950.
    - c. Deliver valves and fire hydrants removed from lined section of water main and not reused to Commission's warehouse.

D. Field Quality Control.

1. Inspection.
  - a. Provide CCTV inspection of completed lining sections at Engineer's direction.
  - b. Use equipment approved for use in potable water system.
  - c. Correct defective lining at Engineer's approval.
2. Removal of Test Section.
  - a. At Engineer's direction, excavate, cut, and remove test section of pipe not less than 2 feet, nor more than 3 feet, long for applied cement lining thickness verification and inspection.
  - b. Excavate minimum of 2 feet below pipe to be inspected.
  - c. If thickness is not within requirements specified herein, correct lining thickness at Engineer's approval.
  - d. After inspection, reinstall removed pipe section utilizing sleeves.
  - e. Backfill excavation and repair paving as required.
3. Testing.
  - a. The Commission may test completed sections to determine Hazen-Williams C Factor.
  - b. If Hazen-Williams C Factor ( $C_{hw}$ ) determined by test is less than guaranteed minimum values herein, remand to Engineer for resolution.

## PART 4 MEASUREMENT AND PAYMENT

### 4.1 CLEANING AND LINING WATER MAINS

- A. Measurement: By linear foot of various sizes of water main cleaned and lined, measured horizontally along centerline of pipe, to include valves and fittings.
- B. Payment: At unit price listed in Bid Schedule.
  1. Payment includes providing and removing temporary bypass piping system; required excavations, backfill and bedding; installing mechanical couplings, pipe,

#### 4.2 ADDITIONAL VALVES

- A. Measurement: Each valve installed complete in place including setting of valve box as shown on Standard Details, at Engineer's direction.
- B. Payment: At contingent unit price listed in Bid Schedule.
  - 1. Payment includes excavation; backfill; cutting pipe; installation of valve, fittings and valve box; permanent pavement replacement; and incidental appurtenances.

#### 4.3 TEST SECTIONS

- A. Measurement: Each test section provided, at Engineer's direction.
- B. Payment: At contingent unit price listed in Bid Schedule.
  - 1. Payment includes excavation; backfill; cutting, removing and replacing test section with sleeves; permanent pavement replacement and incidental appurtenances.
  - 2. No payment will be made for test sections where lining thickness is not within requirements specified herein.

#### 4.4 OBSTRUCTIONS

- A. Measurement: Each access opening required to clean and line obstructed portion of work at Engineer's direction.
  - 1. Additional work required by obstructions not shown on 200-foot scaled maps or as-built drawings.
- B. Payment: At contingent unit price listed in Bid Schedule.
  - 1. Payment includes excavation and backfill, installation of mechanical couplings, pipe and fittings, permanent pavement replacement and incidental appurtenances.

#### 4.5 CCTV INSPECTION OF LINED PIPES

- A. Measurement: By linear foot of water main inspected using CCTV, when no lining defects are found in section of pipe televised.
- B. Payment: At contingent unit price listed in Bid Schedule.
  - 1. Payment includes labor, CCTV equipment, recording media, traffic control.
  - 2. No payment will be made for televising sections where lining defects are found.

#### 4.6 REPLACEMENT OF LEAD JOINTS

- A. Payment for replacement of lead joints: See Article 14 of General Conditions.

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