

SECTION C10

CLEANING AND CEMENT LINING

GENERAL

The work under this section consists of the cleaning and cement mortar lining of existing cast iron water mains in place within the limits specified on the contract drawings.

All work done under this section shall be done in accordance with AWWA Specification C602-83 unless otherwise stated herein.

It is the intent of these specifications to secure the best workmanship consistent with the job conditions and the Contractor's skill. No provision in these specifications shall be construed by the Contractor as an excuse for poor workmanship or results. Any requirements which are in conflict with the Contractor's usual methods shall be brought to the attention of the Engineer prior to the start of any work.

MATERIALS

All materials used for the cleaning and cement lining work shall conform to all applicable AWWA Standards unless specifically altered in these specifications.

CONSTRUCTION METHODS

Opening Water Main

- a. The Contractor shall open the water main at:
 1. Each end of the section to be cleaned and lined,
 2. Each main valve being retained for use,
 3. Each bend, fitting and obstruction shown on the contract drawings,
 4. Each location where a new valve is to be installed, and all other locations necessary to perform the work.
- b. All openings required for bends, fittings or obstructions not shown or noted on the contract drawings shall be paid for under pay item C10-50 obstructions.
- c. All openings shall be made by:
 1. Guillotine saw cuts.
 2. An approved power operated pipe cutter.
 3. Removing existing couplings or sleeves, or other approved method resulting in the cut ends of pipe being square and true.
- d. The Contractor shall salvage, clean and cement line, and

re-use any undamaged pipe.

- e. At openings in sections under pressure or in service, the Contractor shall install adequate blocking to prevent movement during the time the pipe is open.

Temporary Pipeline Seals:

- a. The Contractor shall install, maintain and remove temporary pipeline seals to prevent inflow of water into the pipelines to be cement-mortar lined and to allow for proper curing of the cement lining. The seals shall be braced tightly. The design of the seals shall be submitted to the Engineer for approval before installation.

Cleaning

- a. All rust, tubercles, deposits, old coatings, oil, grease dirt, debris and other foreign materials shall be removed by the Contractor to produce a surface satisfactory to the Engineer for the application of cement mortar lining.
- b. Old tar, if satisfactorily adhered to the pipe, may be left in place providing there are no sharp edges between coated and uncoated areas.
- c. Several passages of the cleaning apparatus, in both directions, may be required to produce these specified results.
- d. Nothing shall be left on the pipe surfaces which in any way, or at any time, may harm the cement mortar lining or cause it to be less adherent.
- e. Suitable provisions shall be made to prevent any damage by water used for cleaning the pipe, and in the event of damage, the Contractor shall be fully responsible.
- f. All sediment deposits shall be removed from the service lines after cleaning the main and before any final flushing of the main.

The Contractor may be required to use a method for cleaning which does not include the use of water. Such requirement will be transmitted to the Contractor, in writing, by the Chief Engineer. The Contractor shall be required to submit his method of cleaning to the Chief Engineer for approval.

See Item C10-2 regarding compensation for this restriction.

Cement Mortar Lining

- a. As soon as practically possible after a section has been cleaned to the satisfaction of the Engineer, it shall be cement mortar lined.
- b. The lining shall consist of one course of continuously applied cement mortar placed by a centrifugal machine. Such machine shall project the mortar against the wall of the pipe without rebound and at a sufficient velocity to cause the mortar to be densely packed and to adhere in place.
- c. The Contractor shall limit the maximum distance of a cement lining run to 500 linear feet.
- d. The mortar shall be mechanically troweled or dragged to produce a satisfactorily smooth surface.
- e. The thickness of the lining for cast iron pipes shall be in accordance with Table 1 of Section 3 of the AWWA C602-83 Standard Specifications for Cement Mortar Lining of water pipes in place. In all instances, tolerance for lining thickness shall be plus 1/8 inch with no minus tolerance. The minimum thickness of the lining shall be 3/16 inch.
- f. After lining operation is completed, the newly lined water main shall be filled with water within 24 hours. This water shall not be under pressure.
- g. All openings to the pipe section shall be kept closed to prevent air circulation in order to create a moist atmosphere for adequate curing.

Repairing Water Main Openings and Defective Piping

- a. Closures shall be made with cleaned and lined pipe salvaged from opening the main and new sleeve couplings.
- b. All new materials used to close water main openings must meet all specifications in Section C1 Ductile Iron Pipe and Fittings, contained herein.

Building Service and Branch Connection Cleaning

- a. The Contractor shall clean debris or cement mortar from all building services, branch connections, laterals, blow-offs, pitometer taps, and all other connections.
- b. The cleaning of building services shall be done by

"blowing-back" with air pressure (maximum 20 psi) or excavation, opening and reaming where there operation is impaired by the cleaning and lining operation.

- c. In the event that the "blowing-back" method is used (see b above), the air source shall be regulated to deliver a maximum of 20 psi. Such regulation of the pressure shall be visible on a gauge at all times.

Television Inspection of Cement Lining

All water lines cement lined under this section shall be inspected by means of television camera and video recording.

Television inspection shall be accomplished by the use of closed circuit television and VHS video recorder. The inspection shall be conducted so as to produce continuous video tape recordings of the various pipes lined under this section corresponding to each continuous pipeline section. The total pipeline shall be described by the narrator stating the size, location and limits of each section recorded.

The television camera used for this inspection shall be one especially designed and constructed for pipe inspection and shall have its own lighting system providing light levels from 50 to 100 foot candles. Picture quality shall be such as to produce a continuous 600-line resolution picture showing the entire periphery of the pipe. Picture quality and delineation shall be such that the interior of the pipe can be clearly seen without static interference of any kind.

All excess water shall be removed from the pipeline prior to television inspection.

The videotape furnished to the Commission shall be of the VHS color format and shall have a distance indicator present at all times on the tape. The distance shown on the tape shall not be used for payment purposes, but shall be used for general purposes of locating the section.

Continuous VHS videotapes with voice narration shall be supplied to the Commission, and shall become the property of the Commission.

All television inspection work shall be continuously monitored by a Commission Inspector unless other action is specifically authorized by the Chief Engineer. The Director of Construction shall be notified three (3) days in advance of the proposed inspection to facilitate the assigning of an Inspector.

The Commission shall view the tape within 48 hours of receipt and make a determination as to activating the water pipe.

Videotapes which are taken when there is water in the pipe are not acceptable. The Contractor must revideo the pipe when it is completely free of water.

Chlorination

Upon completion of all cleaning and lining operations and the work has been approved by the Engineer, the Contractor shall disinfect the mains with water containing not less than fifty parts per million of chlorine in accordance with the AWWA C601 "Procedure for Disinfecting Water Mains".

The Pressure Testing and Disinfection Report in the Appendix of these specifications shall be completed and approved by both the BWSC Engineer and Inspector prior to any payments being made for cleaning and lining.

Obstructions

The Contractor shall make additional openings in the water main, if necessary, at all bends, fittings or other items which hinder the cleaning and cement lining operations.

Only those bends, fittings or other items NOT SHOWN OR NOTED ON THE PLANS will be considered Obstructions for payment purposes.

Guarantee of Cement Mortar Lining

- a. The Contractor shall guarantee all materials and workmanship furnished under this contract against deterioration and failure for a period of 1 year after acceptance of the work.
- b. During this period, any portion of the cement-mortar lining found to be deteriorated or to have failed shall be repaired by patching or by removal and replacement of the cement-mortar lining by the Contractor, as may be deemed necessary by the Engineer, to provide a sound durable cement-mortar lining. Repairs or replacements shall be done at the sole expense of the Contractor, and in full conformity with these specifications, including removal of defective lining, cleaning of the pipe, cutting and repairing, closing access openings and all other incidental work.
- c. Contractors shall be required to guarantee all cleaned and cement-lined water mains, meet the following "C" coefficients, with proper allowance being made for bends and fittings, in accordance with accepted practice.

Nominal Pipe
Diameter

Guaranteed Coefficient "C"
Hazen-Williams Formula

48" C.I.	120
36" C.I.	120
30" C.I.	120
24" C.I.	120
20" C.I.	120
16" C.I.	120
12" C.I.	120
10" C.I.	115
8" C.I.	110
6" C.I.	100

- d. The Boston Water and Sewer Commission shall make loss of head tests after the mains under this contract have been cleaned and cement-mortar lined to determine "C" coefficients for the various diameter mains.
- e. For such cleaned and cement-mortar lined water mains that fail to meet the "C" coefficient determined by loss of head tests, two percent (2%) will be deducted from the contract price after the drop of "C" coefficient to four (4) points below the guarantee and a one percent (1%) additional deduction from the contract price for each two-(2) point drop in "C" coefficient thereafter.
- f. It shall be understood, for the purpose of establishing the "C" coefficient on such mains where it is not practical to carry the loss of head test through sections thereof shall be tested and the weighted average coefficient "C" from tests of such portions shall be considered to be acceptable for the whole of the cleaned and cement-lined mains.
- g. For such cleaned and cement-mortar lined water mains that fall below the guaranteed coefficient "C" to the extend of ten (10) points or more because of poor workmanship, the Engineer shall decide whether the deduction in payment shall be made in accordance with the terms indicated above, or if the cement-mortar lining shall be removed and the water main properly cement-mortar lined at no added expense to the Commission.
- h. It shall be understood that all tests for establishing the coefficient "C" for water mains cleaned and cement mortar lined under this contract shall be completed within one (1) year after contract work is finished.

MEASUREMENT AND PAYMENT

Item C10-50 Obstructions Each

The quantity of Obstructions to be paid for under this item shall be the actual number of additional openings made by the Contractor at bends, fittings or other obstructions NOT SHOWN OR NOTED ON THE PLANS that prevent the proper cleaning and cement lining of an existing water main.

Additional openings required by the Contractor for cleaning gate valves, services or laterals that have become plugged because of the cement lining or because his apparatus cannot properly clean or cement line continuously a full section of straight pipe, shall not be included for payment under this item.

The fixed price paid under this item shall be full compensation for excavation, cutting the pipe, removing the obstruction, replacing all fittings (or re-using salvaged fittings after cement lining them) and pipe, furnishing and setting couplings as needed, and placing and compacting backfill materials. Furnishing backfill materials and any necessary rock excavations shall be paid for under the appropriate separate items.

Item C10-2 Alternate Method of Cleaning L.F.

The quantity to be paid under this item shall be equal to the quantity of water main cleaned by the alternate method (Page C10-2, paragraph g.).

The unit price paid for this item shall be full compensation for all work and/or delays which may occur due to being ordered to clean the main without the use of water.

The unit price for this item is set at \$1.00 (one dollar) per linear foot.

Item C10-6 Clean and Cement Line 6 inch pipe Linear foot

Item C10-8 Clean and Cement Line 8 inch pipe Linear foot

Item C10-10 Clean and Cement Line 10 inch pipe Linear foot

Item C10-12 Clean and Cement Line 12 inch pipe Linear foot

Item C10-16 Clean and Cement Line 16 inch pipe Linear foot

The length of cleaning and cement lining of iron water main to be paid for under the appropriate size designated shall be measured by the linear foot, along the finished grade over the pipe from end to end. No deduction for the length of valves or fittings in the pipe shall be made.

The unit price paid for Cleaning and Cement Lining of water mains shall be full compensation for cutting and disposal of pavement, trench excavation, sheeting and bracing as required, dewatering, placing and compacting backfill material, removal and disposal of any existing water main or fittings shown on the plans, removal and delivery to BWSC storage yard of any valves or appurtenances shown on the plans, furnishing and laying new ductile iron pipe to replace existing pipe damaged by the Contractor, cutting existing water mains for access to clean and cement line, all labor, equipment and materials necessary to clean and cement line the existing pipe, disinfection and testing, all couplings which may be needed and all other work necessary to clean and cement line the water pipe which are not paid for under other items.

No payment will be made until the Engineer has reviewed the videotape of the cleaning and cement lining of each section of pipe and accepted the work.

Item C10-75 Television Inspection L.F.

The length of water main televised shall be measured by the linear foot as above for the Clean and Cement Line items.

The unit price shall constitute full compensation for all labor, tools, equipment, videotape, and related work necessary to satisfactorily inspect the cement lined pipe.

There shall be no additional payments for delays or work necessary to overcome obstructions to the passage of the camera.