

SECTION 15109

PRESTRESSED CONCRETE CYLINDER PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Specified
The work specified shall include all labor, materials, tools, equipment, services, and incidentals necessary to furnish and install prestressed concrete cylinder water piping and fittings as shown, specified and required.
- B. Related Work Specified Elsewhere
 - 1. Section 03300 - Concrete
 - 2. Section 15051 - Buried Piping Installation
 - 3. Section 15110 - Valves and Appurtenances
 - 4. Section 15140 - Testing and Disinfection

1.02 QUALITY ASSURANCE

- A. CONTRACTOR'S Qualifications
 - 1. CONTRACTOR shall have a minimum of 5 years experience installing prestressed concrete cylinder pipe, fittings, and appurtenances.
 - 2. A list of qualifications must be presented including:
 - a. The number of years your organization has been installing prestressed concrete cylinder pipe under your present name.
 - b. Any projects similar to this project completed by your organization. Include all projects completed within the last three years and all projects completed for the Authority specifically within the last five years.
 - c. List the names of any company that has operated under the umbrella of your organization and the projects that they have completed.
- B. Welder's Qualifications
 - 1. All welders and welding operators shall be qualified under AWS D1.1 Structural Welding Code – Steel, under AWS D1.3 Structural Welding Code – Sheet Steel, or under Sec. IX of the ASME Boiler and Pressure Vessel Code for Welding P – No. 1 (carbon or low alloy) steels. For the purpose of this standard, welders and the welding operators qualified under Sec. IX of the ASME Boiler and Pressure Vessel Code to weld P – No. 1 steels shall be deemed qualified to weld any combination of steels listed in Sec. 4.6 of AWWA C-301. Each welder and welding operator shall have qualified or requalified within the past three (3) years.

C. Manufacturer's Qualifications

1. Manufacturer shall have a minimum of 5 years experience producing prestressed concrete cylinder pipe, fittings, and appurtenances, and shall show evidence of at least 5 installations in satisfactory operation.
2. Parts Interchangeability: It is the intent of these specifications that all materials furnished herein shall be compatible with similar materials of other manufacturers. This interchangeability for both cylinder and embedded cylinder pipe shall include, but not be limited to the following components: cylinder outside diameter, joint ring outside diameter, joint depth (stab depth), and joint O-ring gasket. Care must always be taken to assure that the interchangeable pipe has the proper design for both external and internal pressures (working plus surge) and have the proper cylinder thickness if installed in a restrained joint area of the pipeline.

D. Marking for Identification

1. All pipe, fittings, and specials shall have the pipe class and specification designation with size and length dimensions stenciled thereon. Pipe that has been designed for pipe load conditions or thrust restraint shall have special markings thereon which can be readily identified. The name or trademark of the manufacturer, and the date and place of manufacture shall also be stenciled on the pipe, fittings, and specials. The piping for each service or system as specified herein shall be provided by a manufacturer who has thoroughly familiarized himself with the design intent of the overall system and will provide piping suitable for the service intended.

E. Reference Standards

1. AWWA C301, Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
2. AWWA C304, Design of Prestressed Concrete Cylinder Pipe
3. AWWA Manual M9, Concrete Pressure Pipe
4. AWWA C651, Preventative and Corrective Measures During Construction
5. NSF/ANSI Standard 61
6. Underwriter's Laboratories (UL)
7. International Organization for Standardization (ISO)
8. Factory Mutual Research Corporation

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Information on the product confirming compliance with the specified standard and any modifications included in this specification section.
2. As a minimum, the submittal shall include the following: design data sheet(s), pipe and joint detail drawings, restrained joint detail drawings, closure details (restrained and unrestrained), fitting detail drawings, and

- pipe laying schedule. The submittal should note any exceptions to AWWA C301 and any modifications included in this specification section.
3. Material specifications and certifications.
 4. Shop drawings and affidavit of compliance per AWWA C301.
 5. Design calculations (for information only) per AWWA C301 and AWWA C304. The CONTRACTOR shall submit to the ENGINEER the design calculations for each size and class of pipe. Along with each design, the CONTRACTOR shall include the calculated, explicit safety factor of 2.0 times working pressure plus 100 psi surge, including working external loads, where the maximum tensile stress in prestressing wire shall not exceed its yield strength, f_{sy} .
 6. The manufacturer is solely and fully responsible for pipe manufacture in accordance with the design criteria contained in the plans and specifications.
 7. Affidavit that all materials conform to AWWA C301 and any modifications included in this specification section.
 8. Affidavit that all tests called for in AWWA C301 and any modifications included in this specification section have been performed and that all results indicate conformance to AWWA C301 and any modifications included in this specification section.
 9. A complete indexed booklet (for information only) containing all data, design mixes, certified test (and certified retests, if any), reports, etc. for the pipe components (concrete, steel, wire, mortar, etc.) and the pipe fittings and specials. This booklet shall also include production information for each piece of pipe-by-pipe identification number.
 10. Pipe repair procedures, if procedures different than AWWA C301 are to be used.
 11. Written procedures for field repairs of pipe.
 12. Submit certificate of compliance with NSF/ANSI Standard 61 for all products under this section, including interior coatings, by an independent, authorized laboratory.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. During delivery and handling, all materials shall be braced and protected from any distortion or damage; any such distortion or damage shall be basis for rejection of the materials.
- B. Equipment used for unloading shall be covered with wood or rubber to avoid damage to the exterior of the pipe, fittings and appurtenances. Do not drop or roll materials off trucks. All prestressed concrete cylinder pipe and fittings shall be handled with padded slings or other appropriate equipment. The use of cables, hooks or chains will not be permitted.

- C. The materials shall be inspected before and after unloading. Materials that are found to be cracked, gouged, chipped, or otherwise damaged will not be accepted.
- D. Interiors of pipe, fittings and appurtenances shall be kept free from dirt and foreign matter.
- E. Store pipe and fittings on heavy wood blocking or platforms so they are not in contact with the ground.
- F. Pipe, fittings, and specials shall be unloaded opposite to or as close to the place where they are to be laid as is practical to avoid unnecessary handling.

1.05 PIPE INSTALLATION SPECIALIST

- A. A factory trained and certified manufacturer's pipe installation specialist shall be present during CONTRACTOR start-up and for a total of 5 working days when pipe laying is in progress and thereafter shall be available during the course of the project to assist the OWNER, ENGINEER, and/or CONTRACTOR when requested by the OWNER, ENGINEER, and/or CONTRACTOR. This field service shall be at no cost to the OWNER. This can include field review of pipe/fittings when requested by the OWNER, ENGINEER, and/or CONTRACTOR
- B. The specialist shall submit three (3) copies of a written report to the ENGINEER presenting the findings of each visit. As a minimum, each report should include the following: date, day, time, purpose of the visit (and who initiated the visit), weather conditions, CONTRACTOR'S name, project name and the contract number, ENGINEER'S name, individuals contacted, location visited (station, street, field office, ENGINEER'S main office, OWNER'S office, CONTRACTOR'S office, etc.), and any other pertinent information related to the visit (such as the results of individual pipe/fitting inspections, etc.)

PART 2 - PRODUCTS

2.01 PRESTRESSED CONCRETE CYLINDER PRESSURE PIPE

- A. General
 - 1. All products, including interior coatings shall be suitable for use in a potable water system.
 - 2. All products including wetted parts shall be certified to meet NSF/ANSI Standard 61.
 - 3. Prestressed concrete cylinder pipe shall consist of a steel shell with steel bell and spigot end-rings welded to the ends of the cylinder.

4. Joint O-ring gaskets shall be interchangeable with other pipe of same size of other manufacturers. The composition of the rubber shall be either natural or synthetic rubber. Gaskets removed from existing pipe shall not be reused.
5. Restrained joints shall be designed for working pressure (P_w) plus surge pressure (P_s).
6. All necessary fittings, outlets, bevels, bevel adapters, restrained joints, closure pieces shall be provided when specified.
7. All prestressed concrete cylinder pipe, fittings, and accessories must be new materials in first-class condition. Used or recycled materials will not be allowed, regardless of condition. Pipe shall not be supplied from inventory, but shall be manufactured specifically for this Contract.
8. Manufacturer of prestressed concrete cylinder pipe, fittings, and appurtenances shall be:
 - a. Price Brothers, Inc.,
 - b. Or approved equal.

B. Prestressed Concrete Steel Cylinder Pipe (Lined Cylinder and Embedded Cylinder Pipe).

1. Steel cylinders shall meet the requirements of AWWA C301 and shall be of sufficient thickness such that the stress in the cylinder at the specified working pressure plus surge is no greater than 50% of the specified minimum yield of the material as stated in AWWA C301 section 4.4.7.1; and in no case shall the cylinder thickness be less than 0.0747" (14 gauge).
2. The required area of steel for prestressed concrete pipe shall have a single layer of prestressing. Any design with multiple layers of prestressing wire shall not be acceptable.
3. All prestressed concrete pipe shall be manufactured in nominal 20-foot laying lengths. Concrete cores for pipe shall be manufactured per AWWA 301.
4. The pipe "Class" shall be clearly marked per AWWA C301. Markings indicating the pipe class and identifying each pipe in reference to the laying schedule shall also be included. Each pipe shall have an identification number to correlate production information such as concrete core placement, prestressing and mortar coating. A record of this production information shall be furnished. Each length of straight and special pipe and each fitting shall be plainly marked on the interior on the bell end.
5. Transient pressures, earth loads, and live loads above the design pressure shall be accounted for as outlined in AWWA C301. All highway live loads (including impact) shall be American Association of State Highway Transportation Officials HS-20 loading. Where specified, the live load for railroad crossing shall be Cooper E-80 loading

C. Design Conditions

1. Prestressed concrete cylinder pipe and fittings shall have a single design for each size of pipe furnished. There shall be no circumstance where multiple designs will be acceptable for any given size with the exceptions of: a design for restrained areas where heavier cylinders will be required; and, a design for deep stream/road/railroad crossings. The single design per size shall be in accordance with AWWA C304 for the following parameters:
 - a. Pipe inside diameter (d_i): As shown on plans.
 - b. Operating pressure (P_w): See Section 15051, Buried Piping Installation.
 - c. Surge pressure (P_t): 100 psi, minimum, or as otherwise specified.
 - d. Total design pressure: (cumulative sum of b and c), minimum, or as otherwise specified.
 - e. Field hydrostatic test pressure (P_{ft}): See Section 15051, Buried Piping Installation (as measured at the lowest point in the pipeline gradient), or as otherwise specified.
 - f. Safety Factor: 2.0 (based on conditions described in 1.03.A.5.)
 - g. Laying Condition: As shown on plans.
 - h. Depth of cover (H): As shown on plans (8 feet minimum).
 - i. Soil weight: 120 lbs per cubic foot.
 - j. Live loading: AASHTO H20.
 - k. In combination with the internal pressures, pipe, fittings, and specials shall be designed for the external condition listed below which results in a single class of pipe for each size of pipe:
 - 1) Earth cover for existing grade as shown on Drawings, plus all applicable transient and live loads.
 - 2) Earth cover for proposed grade as shown on Drawings plus all applicable transient and live loads.
 - 3) All combinations of earth cover between the existing and proposed grades as shown on the drawings plus the applicable live loads (highway or railroad).

D. Joints for Prestressed Concrete Steel Cylinder Pipe

1. Prestressed concrete cylinder pipe joints shall be sealed by a rubber gasket so that the joint will remain tight under all conditions of service, including movement due to expansion, contraction, and normal settlement. Exposed portions of the joint rings shall be protected by a coating as specified in 2.01.H. following.

2. Exterior joints shall be protected with cement grout (1 part cement to 3 parts sand) poured into a joint grout band or “diaper” after the pipe is firmly bedded and at least partially backfilled to avoid movement after the joint has been grouted. All joint grout bands shall be a minimum of 12-inch wide and be lined with earthfoam®.
3. All watermains shall require mechanically restrained joints at each fitting causing a change in direction of 7-1/2 degrees or greater. The restrained joint shall provide uniform retainage 360 degrees around the pipe joint. Prestressed concrete cylinder pipe shall be restrained where specified or indicated on the drawings with a harness clamp ring or with a snap ring. These types of joints shall allow flexibility.
4. Bonded joints may be required in areas where the ENGINEER has evaluated soil conditions and has recommended that corrosion protection is required at locations shown on the drawings. The pipe manufacturer shall supply all joint bonding materials, including #4 AWG stranded insulated copper wires bonding jumpers, to be field CAD welded to the joint rings when specified.
5. Where joints on existing pipe are required to be restrained, such restraint shall be accomplished by welding the joint. Extreme care should be taken when restraining multiple lengths of any existing prestressed concrete cylinder pipe that have not been designed to resist axial thrust loads. The CONTRACTOR shall verify the steel cylinder thickness prior to restraining the existing pipe by welding joints.
6. Steel cylinder design for all areas requiring restrained joints shall be based on the type of fitting (i.e. deflection angle of bend, valve, or tee), working pressure plus surge, and an allowable longitudinal stress of 13,500 psi (14-gauge minimum).

E. Fittings, Outlets, Caps and Bevels

1. Outlets, connections, and appurtenances shall be of a size and class suitable for the pipe with which they are intended to be used.
2. Suitable watertight end caps or plugs, approved by the ENGINEER, shall be furnished for the purpose of capping the ends of pipe when pipe laying is not actually in progress.
3. Bevel pipe and/or bevel adapters shall be used where the required deflection of the pipeline is more than what is allowed by the joint opening method for straight pipe or as specified.
4. Other accessories not included under AWWA C301 shall be in accordance with the appropriate standard.

F. Harnessed Bulkheads, Plugs, and Caps

1. Harnessed dished bulkheads, plugs, and caps shall be provided as shown and/or required and shall be designed for the conditions stated herein. Plugs and caps shall be flat steel plates for temporary protection. The flat plates shall be reinforced with stiffeners. Permanent bulkheads shall be

dish-shaped steel plates protected by concrete. Two, outlets with plugs, sized as shown on the plans (2-inch minimum), shall be provided in each bulkhead for pipe filling/testing purposes.

G. Construction and Materials

1. All pipe, fittings, specials, bends, closure pieces, joints, gaskets, etc., shall conform to the requirements of AWWA C301.
2. Physical Features of Pipe:
 - a. Steel cylinder shall be formed by spiral-welding steel coil with a full penetration lap-seam weld.
 - b. Steel bell and spigot end-rings shall be welded to the ends of the cylinder.
 - c. O-ring gasket shall be natural or synthetic rubber gasket conforming to AWWA C301.
 - d. Concrete cores for all prestressed concrete pipe shall be manufactured per AWWA C301.
 - e. Minimum steel cylinder thickness to be used in fittings and specials shall be $\frac{3}{8}$ -inch
 - f. Prestressing wire for precompression of the concrete core shall be a minimum of 6 gauge and shall have yield and tensile strengths equal to or less than that of Class II meeting the requirements of ASTM A648.
 - g. Cement mortar coating per AWWA C301 shall be a minimum of $\frac{3}{4}$ inch over the prestressing wire.

H. Coatings, Linings, and Polyethylene Encasement For Prestressed Concrete Cylinder Pipe

1. Exposed Steel Joint Rings:
 - a. Exposed portions of the joint rings shall be protected by a zinc metallized coating having a minimum thickness of 0.004 inch with a grout or cement mortar placed after installation in accordance with the pipe manufacturer's recommendation.
2. All coatings shall be applied in accordance with the coating manufacturer's instructions. All surface preparation and primers required to ensure a lasting coating and lining shall be provided.
3. All linings shall be applied by the pipe manufacturer at the pipe manufacturing facility.
4. Repair Damaged Protective Coatings: prepare surfaces and apply coatings in accordance with manufacturer's instructions. Use coating material and application rate specified in this Section.
5. Polyethylene Encasement For Prestressed Concrete Cylinder Pipe and Fittings.
 - a. Polyethylene encasement shall conform to AWWA Specification C105.

- b. Polyethylene film shall be manufactured of virgin polyethylene material conforming to the following requirements of ASTM Standard Specification D1248 – Polyethylene Plastics Molding and Extrusion Materials.
- c. Polyethylene film shall have a tensile strength of 1,200 psi minimum and shall allow elongation of 300 percent and have a dielectric strength of 800 V/mil thickness minimum.
- d. Polyethylene film shall have a minimum nominal thickness of 0.008 inch (8 mils). The minus tolerance of thickness shall not exceed 10 percent of the nominal thickness.
- e. Tape required to complete the installation shall be approximately two (2) inches wide, plastic backed adhesive type, such as Polyken #900, Scotchrap #50, or approved equal.
- f. Tube size or sheet width for each size of pipe shall be in accordance with AWWA C-105.

I. Additional Piping Required

- 1. In addition to pipe shown on the Drawings and necessary to complete Work, CONTRACTOR shall furnish additional prestressed concrete cylinder pipe pieces. This includes having a number of shorts and bends on hand in the event that there is a need for correction in line of work due to unforeseen errors or obstructions. As a minimum, the following shall be supplied for each size of pipe:
 - a. Two (2) half bevel adapters,
 - b. Two (2) full bevel adapters,
 - c. One (1) short,
 - d. One (1) closure,
 - e. One (1) PCCP Bell x DIP (MJ Spigot)
 - f. One (1) PCCP Bell x DIP (MJ Bell).
- 2. If any of the above pieces are used in the Work, CONTRACTOR shall install the additional fittings, shorts, and closures at no additional cost to OWNER.
- 3. In the event fittings, shorts, and/or closure pieces are not utilized, the OWNER may purchase them at the CONTRACTOR'S invoice price plus a 10% handling fee. If the OWNER chooses not to purchase these additional items, they shall be returned and the OWNER shall only be responsible for a restocking fee.
- 4. Included are all necessary restraints, adapters, bolts, grout, and other appurtenances necessary for installation of the pieces as specified.

J. Closure Pieces

- 1. Follower ring type closure pieces shall be furnished and installed where required by the CONTRACTOR. These shall be furnished by the pipe manufacturer.

- a. The pipe layout submitted by the manufacturer shall reflect the CONTRACTOR'S planned schedule for operations and the schedule of construction. Pipe closures shall be designed by the manufacturer for the pressure required and shall be located in straight runs of pipe. The number, design, and location of all closure pieces shall be as shown or subject to the approval of the ENGINEER. All closure pieces shall be restrained.
- b. The CONTRACTOR may elect either to cut the closure cylinder to the required length in the field, or if timing permits, to have the pipe manufacturer supply the required length base upon exact field measurements.
- c. All closures, including concrete required for protection of the cylinder and joint rings, shall be provided.

PART 3 - EXECUTION

3.01 PRESTRESSED CONCRETE CYLINDER PIPE.

- A. Before the pipe is lowered into the trench, the mortar coating at the pipe ends and both end rings should be thoroughly cleaned and carefully checked for damage. The bell joint ring shall be smooth and free from burrs and deformations. Before the gasket is installed, it shall be thoroughly lubricated by immersing it in a viscous solution of vegetable soap.
- B. After the pipe has been lowered into the ditch, the lubricated gasket should be stretched around the spigot and settled into the circumferential groove.
- C. While the pipe is still clear of the trench bottom, it shall be aligned with the pipe to which it will be joined. As the pipe is advanced toward the pipe in place, the spigot is depressed manually and guided into the flare of the bell.
- D. Long radius curves may be accomplished by opening one side of the joint between straight sections of pipe. Before the joint is opened, the pipe must be brought straight "home" and then deflected toward the inside of the curve. Deflection of joint openings shall not exceed 50% of the manufacturer's recommendations. Long radius curves can also be achieved by the use of half and full bevel pipe joints and/or adapters.
- E. The joints of pipes 24 inches in diameter and larger may be checked from within the pipe. As the spigot is thrust "home", its advance is checked by two steel inserts in the seat of the bell, 180 degrees apart. These inserts are then removed and a feeler gauge is entered into the recess until the gasket can be felt. If any irregularity is detected in the position of the gasket, the pipe must be removed and the gasket examined for cuts. If undamaged, it may be used again after both, the gasket and the joint are relubricated.

- F. Prior to the installation of adjacent pipe, a joint diaper shall be placed around the bell of the pipe already laid. After the installation of the adjacent pipe, the diaper shall be slipped forward to cover the joint recess and fastened in place with either wire or steel strapping stitched into its edges. A 1:3 cement mortar grout mixture (1 part cement to 3 parts sand) shall then be poured into the joint recess beneath the diaper and rodded to assure complete filling of the entire diaper and recess.
- G. Complete installation of polyethylene encasement prior to backfilling.

3.02 ULTRASONIC JOINT TESTING

- A. Each joint shall, at the CONTRACTOR'S sole cost and expense, be tested with ultrasonic test equipment prior to being backfilled. If a leak is detected, corrective action shall be taken prior to installing the next pipe.
- B. The fact that a point (or joints) has passed the ultrasonic testing does not waive the requirements for the hydrostatic tests described herein.
- C. The testing equipment shall be as manufactured by Moffat Enterprises of Powell Butte, or equal.

3.03 HYDROSTATIC PRESSURE AND LEAKAGE TEST

- A. After the transmission main has been laid and the joints completed, this newly laid pipe shall be subjected to a pressure and leakage test.
- B. The test pressure for this test shall be as specified in Section 15051, Buried Piping Installation, and shall be measured at the lowest point in the test section.

3.04 DURATION

- A. The duration of the hydrostatic pressure and leakage test shall be as specified in Section 15051, Buried Piping Installation.

3.05 PROCEDURE

- A. The pipe shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. Prior to testing, the pipe shall be allowed to soak under low pressure to allow the pipe walls to absorb water and for temperature stabilization. The pump, pipe, gauges, water, and measuring devices will be furnished by the CONTRACTOR. All work shall be accomplished by the CONTRACTOR.
- B. When filling of the new line is achieved by accepting water from an existing waterline, the CONTRACTOR shall, as minimum, furnish and install apparatus

such as a reduced pressure zone backflow preventer at the source of the supply to protect against the backflow of water from the new line to the existing line. Water for these purposes shall be metered. The pipeline shall be allowed to soak under low pressure to allow the pipe walls to absorb water and for temperature stabilization.

- C. Testing shall be done as soon as the line is installed as determined by the ENGINEER.
- D. The pressure and leakage test shall be performed as follows:
 - 1. For the entire Contract from the beginning station to the end station.
 - 2. For each valved section of the Contract (i.e., from line valve to line valve). These series of section tests shall be performed so that each section is tested separately and so that each butterfly line valve is tested in both directions.
 - 3. The CONTRACTOR shall furnish outlets for filling with water, expelling air, and testing each section as required. Outlets shall also be provided for sample points as shown on the drawings. These outlets shall be manufactured with the pipe.
 - 4. All tests shall indicate satisfactory results.

3.06 EXPELLING AIR BEFORE TESTING

- A. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, factory installed outlets shall be furnished at various locations and elevations in the test section including the points of highest elevation in the test section. After satisfactory test results these outlets shall be tightly plugged if no longer required.
- B. When test bulkheads are used for testing, they shall include two (2) outlets, one for filling and one for releasing air.

3.07 PRESSURE AND LEAKAGE TEST

- A. All exposed pipes, joints, and fittings which are exposed when the test is conducted shall be carefully examined for visible leakage. Those portions of the pipeline covered by backfill shall be walked to observe leakage appearing on the ground surface. Any leaks discovered in the joints shall be corrected until tight. Any cracked or defective pipe, fittings, etc. discovered in consequence of this pressure test shall be removed and replaced by the CONTRACTOR with new material as previously specified and the test repeated until satisfactory to the ENGINEER.
- B. Suitable means (acceptable to ENGINEER) shall be provided by the CONTRACTOR for determining the quantity of water loss by leakage under the

specified test pressure. No pipe installation will be acceptable until, or unless, this leakage is less than specified.

- C. Allowable leakage shall be as specified in Section 15140, Testing and Disinfection.
- D. Should any test of pipe laid disclose leakage per mile of pipe greater than that specified, the CONTRACTOR shall, at his own expense, locate and repair the defective joints or pipe until the leakage is within the specified allowable.

3.08 LEAKAGE DEFINED

- A. Leakage is defined as the quantity of water to be supplied into the newly laid pipe necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled.

3.09 WATER FOR TESTING

- A. Water for performing the first filling, flushing, and testing operations shall be furnished by the OWNER. Disposal of all water shall be by the CONTRACTOR at his expense. If the water for filling and testing is obtained from an existing waterline, a meter shall be installed to measure the quantity of water used for these purposes. No water shall be obtained from an existing waterline unless the CONTRACTOR first obtains the consent of the agency having jurisdiction over the existing main. Existing codes may restrict the amount and rate of water that can be obtained from the existing line and the CONTRACTOR shall comply with the directions of the agency of jurisdiction or the ENGINEER in this regard. If additional water is required for any reason (refilling, retesting, etc.), the water shall be at the CONTRACTOR'S expense.
- B. If test results are unsatisfactory and additional water is required to refill, retest, etc., additional water shall be at the CONTRACTOR'S expense.

3.10 DISINFECTION

- A. All watermains shall be disinfected in accordance with AWWA C601 and Section 15140, Testing and Disinfection.

END OF SECTION