

^{A5}**SECTION 33 11 00.13 – WATER UTILITY MAIN LINES**

1.01 SUMMARY:

- A. **Basic Function:** ^{A17}The work covered under this Section involves the provision of all new and temporary water mains required to provide uninterrupted continuous service from the existing water mains affected by the Works. ^{A17} This includes the stretches that shall be installed through the Crossunder to be built under the Contract.

1. All the design work required for the temporary and permanent water mains.
2. ^{A17}Temporary water mains to replace existing water mains disturbed by the Works. ^{A17}
3. Sealing and abandoning in place the existing mains after the temporary water mains have been tested and accepted.
4. Fabrication and installation of the new water mains at their final location and acceptance testing of the mains across both new lock complexes, in order to ensure clean and sufficient water at an appropriate pressure on a 24-hour-a-day basis. Sealing and abandoning in place the temporary water mains after the new permanent water mains have been tested and accepted.

B. **Related Sections:**

1. Section 01 14 00 (*Work Restrictions*)
2. Section 01 86 13 (*Plant Mechanical Systems and Equipment*)
3. Section 09 96 00 (*Corrosion Control Coatings*)
4. Section 26 42 00 (*Cathodic Protection*)
5. Section 33 11 00 (*Water Utility Distribution Piping*)

1.02 REFERENCES:

A. ^{A17}**Reference Standards** ^{A17}:

1. **American Water Works Association (AWWA) Publications:**

C 104/A21.3-03	Cement - Mortar Lining for Ductile-iron Pipe and Fittings for Water
C 110/A21.10-03	Ductile-Iron and Gray-Iron Fittings for Water
C 111/A21.11-07	Rubber-gasket Joints for Ductile-iron Pressure Pipe and Fittings

C 151/A21.51-02	Ductile Iron Pipe, Centrifugally Cast, for Water
C 500-02	Metal-seated Gate Valves for Water Supply Service
C 504-06	Rubber-seated Butterfly Valves
C 508-01	Swing-Check Valves For Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
C 550-05	Protective Epoxic Interior Coatings for Valves and Hydrants
C 600-05	Installation of Ductile-iron Water Mains and their Appurtenances
C 651-05	Disinfecting Water Mains

2. **National Sanitation Foundation (NSF) Publications:**

61-07 Drinking Water System Components – Health Effects.

3. **American Society for Testing and Materials (ASTM) International Standards:**

A 276-06 Stainless Steel Bars and Shapes

A 395/A 395M-99(04) Ferritic Ductile Iron Pressure-retaining Castings for Use at Elevated Temperatures

A 536-88(04) Ductile Iron Castings

A 564/A 564M-04 Hot-Rolled and Cold-finished Age Hardening Stainless and Heat-resisting Steel Bars and Shapes

4. **Autoridad del Canal de Panamá (ACP):**

^{A17}2600SEG-215(R5) Norma para la Conservación de la Audición. ^{A17}

B. **Other Standards:** Refer to Section 01 42 19 (*Reference Standards*).

1.03 REQUIREMENTS:

A. ^{A17}All existing water mains that, due to work at the Site, would end up being more than 2 meters below the final grade shall be replaced with new water mains, placed at an elevation not lower than 2 meters below the final grade. ^{A17}

B. All affected piping shall be replaced with new ductile iron pipes (DIP).

- C. Combination air valves with a minimum diameter of 1/8 of the diameter of water mains shall be installed at high points of the new water mains that have vertical-inflection points, and clean out valves with a minimum diameter of 1/3 of the diameter of the water mains shall be installed at low points.
- D. Push-on mechanical joints shall be used for new water mains buried in earth.
- E. Joints for vertical piping in the Crossunders shall be of the flanged type, and the joints for the horizontal piping shall be of the flanged, restrained mechanical or restrained push-on type.
- F. Length of the vertical piping shall be 6.1 m, and the horizontal piping shall be 3.05 m.
- G. Expansion joints shall be installed at the top of the vertical run of the piping to the Crossunders before the upper elbows.
- H. Expansion joints shall be installed at both ends of the horizontal run of the piping in the Crossunders before the vertical elbows.
- I. At the Pacific Site, the two parallel 16-inch water mains belonging to the Employer that will be disturbed by the work, including the stretches through the Crossunders, shall be replaced by 24-inch DIP Class 250 pipes.
- J. At the Atlantic Site, the 12-inch water mains that will be disturbed by the work, including the stretches through the Crossunders, shall be replaced by 16-inch DIP Class 250 pipes.
- K. ^{A17}The Contractor shall provide all material necessary for connection to the existing water mains.^{A17} Connection will be made by the Employer.
- L. The Contractor shall clean, disinfect, and perform bacteriological analysis on the new piping before placing it into service. The Employer reserves the right to verify the results of the bacteriological analysis.

1.04 DESIGN CRITERIA/SYSTEM DESCRIPTION:

- A. **Existing Hydraulics Conditions:** All lines shall be designed to provide, as a minimum, the same flow and pressure at the point of connection as are present under existing conditions.
- B. **Materials:**
 - 1. **Piping:** The water pipes in the Pacific Crossunders shall be 24-inch DIP Class 250 pipes belonging to the Employer and 30-inch DIP Class 350 belonging to the IDAAN, and the water pipes in the Atlantic Crossunder shall be 16-inch DIP Class 250 pipes belonging to the Employer. All shall be in accordance with AWWA C151 and shall have a standard internal cement-mortar liner in accordance with AWWA C104.

2. **Fittings:** Fittings shall be ductile iron fittings of the push-on type in accordance with AWWA C110 and AWWA C111, with a required minimum operating pressure equal to the connecting piping, unless otherwise indicated herein. The fittings shall have a standard internal cement-mortar liner in accordance with AWWA C104.
3. **Supports:** Exposed pipe shall be securely supported, strapped, anchored, or guided to prevent excessive vibration and to relieve equipment and piping of excessive stress. Supports shall be provided at valves, fittings, outlets, changes in direction, equipment, and accessories.
4. **Gate Valves:** The gate valves shall be designed and fabricated according to the requirements of AWWA C500. The valve body shall be of ductile iron conforming to ASTM A 395/A 395M or A 536. Gate valves of 30-inch diameter or larger shall be provided with a gear system for opening and closing purposes, with a relief line connected directly from the body. The epoxy coating shall conform to AWWA C550 and NSF 61.
5. **Check Valves:** Shall be of the swing type and designed for installing in horizontal position for water service in accordance with AWWA C508.
6. **Butterfly Valves:**
 - a. The butterfly valves shall be Class 150 or 250, designed and fabricated in accordance with AWWA C504. The valves shall be designed for horizontal-pipe mounting and with vertical shafts.
 - b. The butterfly valve body shall be of ductile iron (ASTM A 536 Grade 65-45-12) with stainless steel seat (ASTM A 564/A 564M or A 276, 18-8 Type 304). The shafts shall be of stainless steel, according to ASTM A 564/A 564M or A 276, 18-8 Type 304, with a torque classified as full and Class 150B. The disc shall be ductile iron, ASTM A 536 Grade 65-45-12.
 - c. The epoxy coating shall conform to AWWA C550 and NSF 61.
 - d. Butterfly valves shall be furnished with a manual operator of the worm-gear type, self-locking in any position and sealed, gasketed, and lubricated. ^{A17}The operators shall be specifically designed for the operation of butterfly valves and sized to permit the operation of the valve with full hydraulic unbalance across the valve equal to the design pressure.^{A17} A hand-wheel shall be provided to enable a single person to open and close the valve. The valve shall have a position indicator and an adjustable mechanical stop-limit device. Hex-nut type stops are not acceptable.

7. **Electric-Operated Butterfly Valves:**

- a. Electric actuators shall be rated to produce not less than the required valve-operating torque. Additionally, the motor of electric actuators shall be capable of producing an actuator output on not less than one and a half times the required valve operating torque.
- b. Electric-motor drives shall be equipped with limit switches and torque switches for both open and closed positions.
- c. Any gearing in direct association with the electric-motor drive shall be totally enclosed and shall operate in a lubricant.
- d. Each valve operator shall be provided with a hand-wheel and clutch for manual operation.
- e. Unless otherwise specified, electrically-actuated butterfly valves shall operate from fully open to fully closed positions, or the opposite sequence, in approximately 60 seconds.
- f. The manufacturer shall apply a warning label in the area of the hand wheel listing the maximum number of 90-degree turns from full open to full close and full close to full open.
- g. Each valve shall be capable of opening and closing using 120 VAC power at 60 Hz, and shall be operable by 24 VDC momentary-contact circuits.
- h. Butterfly valves shall be equipped with a local and a remote position indicator, which will indicate the position of the valve opening with respect to the body opening. A mechanical dial position indicator shall show local valve position on a dial graduated in percentage of valve opening.

8. **Valve Boxes:**

- a. **Valve Box for Gate Valves:** The Contractor shall submit a proposed design for the valve box. The valve box shall be made of concrete with a steel cover. The word "AGUA" shall be cast in the cover. The boxes shall be of the depth required for the pipe at the valve location and shall include a dresser type joint or an adapter flange to facilitate changing the valve. There shall be a minimum clear distance of 0.90 m from the pipe to the box to allow adequate space for maintenance personnel.
- b. **Valve Box for Butterfly Valves:** The Contractor shall submit a proposed design for the valve box. The valve box shall be made of concrete or masonry boxes, segmental blocks, and a cast-iron cover. The word "AGUA" shall be cast in the cover. The boxes shall be of the depth required for the pipe at the valve location and shall include a dresser type

joint or an adapter flange to facilitate changing the valve. There shall be a minimum clear distance of 0.90 m from the pipe to the box to allow adequate space for maintenance personnel.

9. **Thrust/Anchor Blocks:** The Contractor shall submit a proposed design for the thrust/anchor blocks. Blocking shall be placed so that fitting joints are accessible for repairs. The thrust blocks shall be designed to support the pressure loads during testing.
 10. **Insulating Joints:** Insulating joints of the Dresser-coupling type shall be installed to connect new and existing pipes or to connect pipes of different material.
- C. **Safety:** The Contractor shall take the required precautions against injury to all personnel working at the Site during the period that work is being performed under this Contract. See Section 01 35 29 (*Health and Safety Management and Emergency Response Procedures*).
- D. **Noise Limits:** ^{A17}Unless otherwise indicated in these specifications, the steady-state noise levels shall be maintained as low as possible, but shall not exceed the limits specified in the Employer's standards on noise levels (see the Employer's publication 2600SEG-215).^{A17} The steady-state noise level at the manned locations shall be maintained at less than 85 dBA in an 8-hr time-weighted average; otherwise, personal protection equipment is required.
- E. **Use of Hazardous Materials:** Prior to incorporating any hazardous material in the design, such as chemicals, insulation, abrasives, coatings, grease, oil, and lubricants, the Contractor shall submit, to the Employer's Representative for review, a list of all hazardous materials proposed. See Section 01 35 29 (*Health and Safety Management and Emergency Response Procedures*).
- F. **Installation:**
1. **Equipment:** Shall be installed according to the manufacturer's recommendations.
 2. **Piping:** Shall be installed in accordance with AWWA C600.
- G. **Corrosion Protection:** The entire installation shall be designed, fabricated, and constructed for a coastal, tropical, industrial, and marine environment. Materials shall be selected and protected to fulfill the mission while minimizing or avoiding the requirement for maintenance. Coatings in contact with water shall be certified by the National Sanitation Foundation (NSF). Ductile-iron piping shall be coated in accordance with Section 09 96 00 (*Corrosion Control Coatings*) and cathodically protected in accordance with Section 26 42 00 (*Cathodic Protection*).
- 1.05 SUBMITTALS:** ^{A17}Whenever data as required below is for the Employer's Representative's review, the results of the Employer's Representative's review will be communicated to the Contractor within 28 days of the Employer's Representative's receipt of the required data.^{A17}

- A. **Preliminary Design Data:** ^{A17} Within 140 days of the Commencement Date and after 30% completion of the design, but prior to the procurement of Materials or Plant, the Contractor shall submit, to the Employer's Representative for review, five sets of 30% design data. ^{A17} The preliminary 30% design data shall include, but not be limited to the Design Analysis. This design analysis shall include a written explanation of the system design and equipment selection. It shall contain a summary of the criteria including codes, references, and safety requirements. The justification for each major selection and design decision shall be clearly stated and include supporting calculations, when applicable.
- B. **Final Design Data:** Within 2 years after receipt of the Letter of Acceptance and after 100% completion of the design, but prior to the procurement of Materials or Plant, the Contractor shall submit, to the Employer's Representative for review, five sets of final design data. The 100% design data, shall include, but not be limited to:
1. **Final Design Analysis:** The design analysis shall include a written explanation of the system design and equipment selection. It shall contain a summary of the criteria including codes, references, and safety requirements. The justification for each major selection and design decision shall be clearly stated and shall include supporting calculations, when applicable.
 2. **Preliminary Design Drawings:** Preliminary design drawings shall be of high quality and complete to permit the Employer a thorough evaluation of the technical-design solutions provided for the proposed water main systems. At least the following drawings shall be submitted:
 - a. Drawings showing the alignment and profile of the temporary water mains required to provide uninterrupted continuous service of the existing water mains, which belong to IDAAN and the Employer.
 - b. Drawings showing the alignment and profile of the permanent water mains (both IDAAN and Employer water mains) required for service through the middle Crossunders.
 3. **Final Systems Detail Drawings:** The Contractor shall submit to the Employer's Representative final drawings showing the general arrangement of piping and equipment, excavation limits, adapters, location of fittings, valve boxes, obstructions, notes, sections, and all necessary details necessary for the construction of the water mains. ^{A17} At least all the drawings listed in Subparagraph 1.05 B.2 and updated as final design drawings. ^{A17} shall be submitted.
- C. **Manufacturer's Catalog Data:** Manufacturer's standard drawings and catalog clippings shall be submitted for:
1. Waterline piping, fittings, reducers, quick disconnects, joints, valves, and couplings.

2. Manholes.
 3. Valve boxes.
- D. **Manufacturer’s Instructions:** ^{A17}Shall be submitted to the Employer’s Representative for review, for each material or procedure to be utilized. ^{A17} The Contractor shall have a copy of the manufacturer’s instructions at the Site at all times and shall follow these instructions unless otherwise directed by the Employer’s Representative.
- E. **Certificates of Compliance:** These certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise, and that production control tests have been performed at the intervals or the frequency specified in the publication. Certificates of compliance shall be submitted for waterline piping, fittings, joints, supports, valves, and couplings.
- F. **Shop Drawings:** Before starting the installation, drawings showing the proposed construction methods for temporary and permanent lines shall be submitted.
- G. **As-Built Drawings:** ^{A17}Prior to the Taking-Over Certificate, the drawings shall be revised by the Contractor to show any deviations from the actual construction of the work indicated in the system detail drawings, and these revised updated drawings shall be submitted to the Employer’s Representative for review. ^{A17}
- H. **Schedule:** The Contractor shall submit schedules for the following activities:
1. Connecting the new water mains to the existing main waterlines.
 2. Connecting the temporary water mains as required to provide uninterrupted continuous service.
 3. Installation of the permanent water mains through the middle Crossunders.
- I. **Disposal Plan:** Before performing the hydrostatic tests and disinfection, the Contractor shall submit a plan for the disposal of the water used for these procedures.
- J. **Disinfection Plan:** The Contractor shall submit a plan for complete piping disinfection.
- K. **Test Results:** Results of testing by a commercial laboratory certified by the “Ministerio de Salud” shall be provided to demonstrate that the IDAAN water mains have been disinfected. The Employer will conduct the test for the Employer’s water mains.
- L. **Statements:** Written statements certifying that:
1. The installation is satisfactory.
 2. The installation complies with all requirements.

3. The installation was done in compliance with the procedures and techniques recommended by the manufacturers.

1.06 QUALITY ASSURANCE:

- A. All materials to be in contact with potable water shall be certified in accordance with NSF 61 and listed on the NSF site (<http://www.nsf.org>).
- B. All components of the piping system shall comply with the requirements of NSF 14 and shall be legibly marked with the NSF symbol.
- C. **Hydrostatic Test:** The Contractor shall conduct pipe testing in accordance with the requirements and procedures indicated in AWWA C600 for hydrostatic testing. Where any section of the water lines is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until the concrete thrust blocking has attained the required strength. The piping shall be tested for the larger of 1.5 times the working pressure or the values indicated for the 24-inch DIP Class 250 pipe at the Pacific Site (350 psi), the 30-inch DIP Class 350 pipe at the Pacific Site (450 psi), and the 16-inch DIP Class 250 pipe at the Atlantic Site (350 psi). All other piping shall be tested at 1.5 times the working pressure.
- D. **Disinfection:** Before acceptance of potable-water operation, each unit of completed waterline shall be disinfected as prescribed in AWWA C651. Required flow and openings shall be in accordance with AWWA C651, Table 3. The Contractor shall disinfect the water system after all the hydrostatic tests are completed and the waterlines accepted. The Employer will perform, at no cost to the Contractor, the initial test to confirm the disinfection of the water piping. ^{A17}However, if the systems do not pass that test, the test will be repeated at the cost of the Contractor.^{A17} After disinfection and later flushing, the Employer will make the tie-in, as specified.

END OF SECTION

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