

## SECTION 02601 – WATER PIPE

### PART 1 – GENERAL

#### 1.1 DESCRIPTION

- A. The WORK under this Section includes providing all labor, materials, tools and equipment necessary for furnishing and installing buried water pipe and fittings, thrust blocks, tie rods, electrical continuity, disinfection and testing. The CONTRACTOR shall install the water pipe and fittings to the horizontal and vertical alignment shown on the Drawings and shall complete all associated WORK described in this Section.

#### 1.2 SUBMITTALS

- A. Water Pipe: Material certifications.

### PART 2 – PRODUCTS

#### 2.1 PIPE

- A. Water pipe shall be ductile-iron pipe (DIP) conforming to the requirements of AWWA C151, with cement mortar lining conforming to the requirements of AWWA C104. Standard Thickness Class 50 pipe shall be used unless otherwise shown on the Drawings. Water pipe shall have an exterior bituminous coating conforming to the requirements of AWWA C110. All water pipe shall be clearly marked with the manufacturer's name, type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

#### 2.2 JOINTS

- A. Unless otherwise shown on the Drawings, CBJ Standard Details, or as specified below, pipe joints shall be push-on rubber gasket type conforming to the requirements of AWWA C111.
- B. DIP placed within pipe casings shall have restrained joint connections. Refer to CBJ Standard Detail 413 – Bored Encasement.
- C. Restrained joint water pipe shall be U.S. Pipe TR FLEX, U.S. Pipe field Loc Gasket, EBBA IRON “Mega-lug System,” Griffin Snap Lock, Pacific State Lock Mechanical type, or approved equal. Restrained push-on joints for pipe shall be designed for a water working pressure of 250 psi and shall be capable of being deflected a minimum of 3% per joint, for pipe sizes through 18 inches, after assembly.

#### 2.3 FITTINGS

- A. Fittings for all water pipe and restrained joint water pipe shall be U.S. Pipe TR FLEX, push-on gasket fittings compatible with U.S. Pipe Field Loc Gasket, mechanical joint fittings with EBBA IRON “Mega-lug System” Griffin Snap Lock, Pacific State Lock Mechanical Type, or approved equal.
- B. For connecting to existing water mains, the CONTRACTOR shall use a mechanical joint tee and a mechanical joint cutting-in-sleeve similar to Clow F-1220 or Mueller H-843, or

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a cast iron coupling similar to Rockwell 431, or approved equal. The length of all sleeves and couplings shall equal or exceed the diameter of the pipe.

- C. All valve clusters consisting of a tee and one or more valves, including fire hydrant legs, shall be monolithically restrained with EBBA Iron “Mega-lug System,” or approved equal.

### 2.4 THAW WIRE

- A. Thaw wire and continuity straps shall be No. 2 copper wire, stranded, with THW insulation or equal. Exothermic welding to attach continuity straps on DIP and fittings shall be “Cadweld” or approved equal and coated with bituminous coating.

### 2.5 UNDERGROUND MARKING TAPE

- A. Underground marking tape shall be blue, six inch wide, four mil thick, polyethylene tape with black lettering with the following wording: “Caution: Waterline Buried Below.” Marking tape shall be installed 12 inches above the top of all water pipe.

### 2.6 TIE RODS

- A. Tie rods shall be threaded black iron or mild steel with a 12-mil minimum asphaltic coating and shall be located symmetrically around the perimeter of the pipe using anchorage lugs of standard manufacture for attachment where required. Unless otherwise shown on the Drawings, the number and size of the rods shall be as shown on the table below:

PIPE SIZE	TIE ROD SIZE	NO. OF RODS
4” – 10”	¾”	2
12” – 16”	¾”	4
18” – 20”	¾”	6
22”	1”	4
24”	1”	6

### 2.7 CONCRETE

- A. Concrete for thrust blocks shall conform to Section 03302 –Concrete Structures.

### 2.8 TEMPORARY WATER SYSTEM

- A. All piping, including hoses used for water service, shall be NSF rated.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. The CONTRACTOR shall preserve and protect all existing utilities and other facilities including but not limited to: telephone, television, electrical, water and sewer utilities, surface or storm drainage, highway or street signs, mail boxes, and survey monuments.

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The CONTRACTOR shall immediately repair or replace utilities or other facilities damaged during construction. The CONTRACTOR shall support and protect any underground utility conduits, pipes, or service lines where they cross the trench.

- B. The CONTRACTOR shall give at least 24 hours notice to the CBJ Water and Wastewater Utility Divisions and the CBJ Engineering Department prior to:
1. needing water or sewer main line locates;
  2. interruption of water service in any area; or
  3. use of water from any fire hydrant.

Any water service disruption shall be restored as soon as possible. The CONTRACTOR shall comply with the current policy on “Water and Sewer Line Locates” of the CBJ Public Works Department, Water and Wastewater Utilities Divisions. The CONTRACTOR shall notify all local radio stations and any major customers who will be affected of a planned water service disruption.

### 3.2 INSTALLATION

- A. Water pipe shall be installed in accordance with the manufacturer’s printed specifications and instructions, and in conformance with AWWA C151.
- B. The water pipe shall be handled carefully to prevent damage to the pipe, pipe lining, or coating. Water pipe and fittings shall be loaded and unloaded using hoists and slings to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled. If any part of the coating or lining is damaged, repair thereof shall be made in a manner satisfactory to the ENGINEER at the CONTRACTOR’s expense.
- C. All water pipe and fittings shall be inspected for defects. Damaged pipe will be rejected and the CONTRACTOR shall immediately place all damaged pipe apart from the undamaged and shall remove the damaged pipe from the site within 24 hours.
- D. Whenever it becomes necessary to cut a length of water pipe, the cut shall be made by abrasive saw or by special pipe cutter.
- E. All pipe ends shall be square with the longitudinal axis of the water pipe and shall be reamed and smoothed to assure a good connection.
- F. The water pipe shall be laid to the horizontal and vertical alignment shown on the Drawings. A minimum five foot cover shall be maintained from finish grade to top of water pipe, unless otherwise shown on the Drawings. Fittings shall be installed at the location shown on the Drawings.
- G. To prevent dirt and other foreign material from entering the pipe and fittings during handling and installation, the open end of the pipe shall be protected by a water-tight plug at all times except when joining the next section of pipe.
- H. Under no circumstances shall pipe deflections, either horizontal or vertical, exceed the manufacturer's printed recommendations. Where deflections would exceed the manufacturer’s recommendations, fittings shall be used.

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- I. Vertical deflections to avoid obstructions that exceed allowable water pipe joint deflections shall be accomplished by the use of fittings and either joint restraints or vertical thrust blocking conforming to the Standard Details. Additional fittings to those indicated on the Drawings will be required to accomplish these vertical deflections.
- J. Concrete thrust blocks shall be furnished and installed in accordance with the Drawings and Standard Details.
- K. Pressurized water pipe ends shall be plugged and thrust blocks installed. Volume and bearing area of thrust blocks for end plugs shall be equal to applicable standards for bends greater than 45°.
- L. Existing water pipes and appurtenances to be removed or abandoned shall be as designated on the Drawings or directed by the ENGINEER. Abandoned water services shall be plugged at the cut ends. Abandoned water pipes shall be removed as shown on the Drawings, or mechanically plugged if not required to be removed.
- M. All pipe fittings shall be restrained with EBBA Iron “Megalug System,” or approved equal.
- N. All joints within 50 feet of tees or bends equal to or greater than 45° shall be restrained joints.
- O. Continuous water services shall be provided for all structures, except for interruptions necessary for connection of temporary or new piping to the existing service or mainline piping.
- P. The CONTRACTOR is responsible for maintaining continuous water service at volume and pressure to match existing to all structures, with either existing, temporary or new piping, except as provided in this Section.

### 3.3 FLUSHING, TESTING AND DISINFECTION

- A. Prior to acceptance, the CONTRACTOR shall “Open-Bore” flush the water pipe then perform hydrostatic tests, electrical continuity tests, and disinfection and coliform tests. Testing may be done in any sequence. However, in the event the disinfection, coliform and continuity tests have been performed and repairs are made to the water pipe system in order to pass the hydrostatic test, all previous tests and the “Open-Bore” flushing shall be repeated to the satisfaction of the ENGINEER.

### 3.4 OPEN-BORE FLUSHING

- A. Open bore flushing is required of all installed water pipes to remove any foreign matter. The CONTRACTOR shall furnish, install and remove all pumps, fittings and pipes necessary to perform the flushing; shall provide all additional excavation and backfill; and shall dispose of all water and debris flushed from the water pipe. Flushing through fire hydrants, reduced outlets or fittings shall not be permitted unless specifically authorized in writing by the ENGINEER. The CONTRACTOR shall notify the

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ENGINEER, in writing, 48 hours in advance of any flushing operation. All flushing shall be done between the hours of 1:00 a.m., and 5:00 a.m., unless otherwise authorized by the ENGINEER. A flushing scheme and schedule shall be submitted by the CONTRACTOR for review and approval by the ENGINEER prior to flushing. The schedule for flushing must be approved by the CBJ Water Utility Division. The CONTRACTOR shall be responsible for obtaining any permits necessary for flushing operations.

### 3.5 HYDROSTATIC TESTING

- A. Hydrostatic testing will be conducted in the presence of the ENGINEER on newly installed water pipes after “Open-Bore” flushing, in accordance with the requirements of AWWA C600 and as stated hereafter. The CONTRACTOR shall furnish all assistance, equipment, labor, materials, and supplies necessary to complete the test to the satisfaction of the ENGINEER. The CONTRACTOR shall suitably valve-off or plug the outlet to existing or previously-tested water pipe prior to performing the required hydrostatic test. Prior to testing, all air shall be expelled from the water pipe. If permanent air vents are not available to accommodate testing, the CONTRACTOR shall install corporation stops and blow-off lines so the air can be expelled as the line is filled with water.
- B. The hydrostatic pressure shall be a minimum of 150 psi or 1½ times the operating pressure of the water pipe (measured at the highest elevation of the newly-installed water pipe), whichever is greater, unless otherwise directed by the ENGINEER. Acceptance pressure testing shall be done with all service lines installed, corporation stops open, and pressure against the closed curb stops. The duration of each hydrostatic pressure test shall be one hour. Pumping will cease after the required test pressure has been reached. If the pressure remains constant for one hour without additional pumping, or pressure drop is less than five psi, that section of water pipe is acceptable.
- C. If the pressure drops five (5) psi or more during the initial one hour hydrostatic pressure test, the CONTRACTOR shall conduct a leakage test. Leakage shall be determined by measuring “make-up” water necessary to restore the specified test pressure. The quantity of water lost from the water pipe shall not exceed the number of gallons per hour as determined by the following formula:

$$L = \frac{ND(P)^{0.5}}{7400}$$

L = Allowable leakage in gallons per hour

N = Summation of mechanical and push-on joints in length of water pipe tested

D = Diameter of water pipe in inches

P = Test pressure in pounds per square inch

- D. Should the tested section fail to meet the pressure test as specified, the CONTRACTOR shall locate and repair the defects and then retest the water pipe as specified above. Any specific leakage point detected shall be corrected by the CONTRACTOR to the satisfaction of the ENGINEER regardless of the allowable leakage specified above.
- E. All tests shall be made with the auxiliary gate valves open and pressure against the hydrant. After the hydrostatic test has been successfully completed, each valve shall be

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tested by closing in turn and relieving the pressure beyond. This test of the valves will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The CONTRACTOR shall verify that the pressure differential across the valve does not exceed the rated working pressure of the valve.

- F. Sections to be tested shall be limited to 1,500 feet, unless otherwise approved in writing by the ENGINEER.
- G. Defective materials or poor quality of WORK, discovered as a result of the hydrostatic tests, shall be replaced by the CONTRACTOR. Whenever it is necessary to replace defective material or correct the workmanship, the hydrostatic test shall be repeated until a satisfactory test is obtained.
- H. The ENGINEER shall be present for all hydrostatic and leakage tests. The CONTRACTOR shall notify the ENGINEER at least 24 hours prior to any test and shall notify the ENGINEER at least two hours in advance of the scheduled time if the test is to be cancelled or postponed.
- I. After completion of testing, all test and air vent pipe shall be removed and the corporation stop closed at the water pipe, in the presence of the ENGINEER.

### 3.6 ELECTRICAL CONTINUITY

- A. Electrical continuity is required for six inch or smaller water pipe and fire hydrant assemblies, and shall be provided by two electrical continuity straps installed on each side of the water pipe joint or fittings. Electrical continuity tests will be performed by the CBJ Water Utility Division staff with a “Hovey” water pipe thawing machine, unless scheduling conflicts or mechanical problems with the thawing machine prevent the CBJ Water Utility Division staff from performing the testing within the time period required by the CONTRACTOR. In those cases that the CBJ Water Utility Division staff is unable to conduct the testing, the CONTRACTOR shall conduct the testing with its own personnel and equipment. The testing shall be performed in a manner that is approved by the ENGINEER.

If the initial testing of an installation within any Project phase fails (the continuity testing will be conducted by the CBJ at one time for each Project phase, as shown on the Drawings, or as directed by the ENGINEER), the additional testing required shall be at the CONTRACTOR’s expense. The CBJ Water Utility Division staff will maintain a circuit of 300 amps DC current for a period of 90 seconds. Current loss, through the test circuit, shall not exceed 10%. Continuity test sections shall not exceed 500 lineal feet. All test leads brought up to the surface shall be removed to a depth of two feet below finish grade upon completion of the tests.

### 3.7 DISINFECTION

- A. Disinfection by chlorination of all new water pipe shall be completed and a satisfactory bacteriological report obtained prior to placing the pipe in service. “Open-bore” flushing shall be completed before chlorination is begun.

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- B. Chlorine shall be applied by one of the following methods:
  1. liquid chlorine gas-water mixture;
  2. direct chlorine gas feed; or
  3. hypochlorite commercial products such as HTH, Perchloren, Macho-chlor, or approved equal.

The chlorinating agent shall be applied at the beginning of the section adjacent to the feeder connection, insuring treatment of the entire water pipe. Water shall be fed slowly into the new water pipe with chlorine applied in amounts to produce a dosage of 50 ppm. Application of the chlorine solution shall continue until the required residual of not less than 50 ppm free chlorine is evident at all extremities of the newly constructed line.

- C. The chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device. Chlorine gas shall be fed directly from a chlorine cylinder equipped with a suitable device for regulating the rate of flow and the effective diffusion of gas within the water pipe. Hypochlorite products shall be placed or injected into the water pipe. During the chlorination process, all intermediate valves and accessories shall be operated. Valves shall be manipulated so that the strong chlorine solution in the water pipe being treated will not flow back into the pipe supplying the water.
- D. The following table is to be used as a guide for chlorinating pipes by the calcium hypochlorite and water mixture method. The given dosage per 100 feet results in a chlorine solution of 40 to 50 ppm. This dosage takes into account that CONTRACTORS most frequently use granular HTH, which is 65% pure. If another chlorinating agent is used, the dosage must be adjusted.

<b>PIPE DIAMETER</b>	<b>DOSAGE PER 100 FEET</b>
4"	.60 oz.
6"	1.35 oz.
8"	2.75 oz.
10"	4.30 oz.
12"	6.19 oz.
16"	11.00 oz.
20"	17.00 oz.

- E. A residual of not less than 50 ppm free chlorine shall be produced in all parts of the water pipe. After 24 hours detention there shall be a minimum free chlorine residual of 25 ppm in all parts of the water pipe. This residual shall then be neutralized in the pipe by injecting an approved reducing agent such as sulfur dioxide, sodium bisulfate, sodium sulfite or sodium thiosulfate.
- F. After the water pipe system has been thoroughly flushed, samples will be taken at representative locations in the system by the ENGINEER, placed in sterile bottles, and submitted to an approved laboratory for bacteriological examination. The presence of bacteria in any sample shall be verified with a second sample at the same location. If verified, the pipe disinfection procedure shall be repeated and additional samples taken for bacteriological examination. Pipe disinfection shall be repeated, at the CONTRACTOR's expense, until satisfactory results are obtained. The first testing

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sequence will be paid for by the OWNER. Any further testing and sampling required due to insufficient disinfection (positive coliform tests) will be paid for by the CONTRACTOR.

- G. The water shall be flushed from the water pipe at its extremities, including all curb stops, until the replacement water chlorine residuals are equal to those of the permanent source of supply. The de-chlorinated water and water used for flushing shall be disposed of in a manner approved by the ENGINEER, and in conformance with current requirements of the Alaska Department of Fish and Game, and the Alaska Department of Environmental Conservation.

**END OF SECTION**