

WATER MAIN ON BRIDGE

**\*\*From Hartford (Wilder) STP 1444(35)**

- xx. DESCRIPTION. This work shall consist of the installation and testing of a water main on a bridge within the limits indicated on the Plans.

The work under this Section shall be performed in accordance with these provisions, the Plans and Section 629 of the Standard Specifications.

- xx. REFERENCE STANDARDS. Information and requirements contained in these provisions are based on the most recent version of the following standards:

- (a) AWWA/ANSI Standard C104/A21.4 for Cement-Mortar Lining for Ductile Iron Pipe and Fittings.
- (b) AWWA/ANSI Standard C110/A21.10 for Ductile Iron Fittings.
- (c) AWWA/ANSI Standard C111/A21.11 for Rubber Gasket Joints for Ductile Iron Pipe and Fittings.
- (d) AWWA/ANSI Standard C150/A21.50 for the Thickness Design of Ductile Iron Pipe.
- (e) AWWA/ANSI Standard C151/A21.51 for Ductile Iron Pipe, centrifugally cast.
- (f) AWWA/ANSI Standard C153/A21.53 for Ductile Iron Compact Fittings.
- (g) AWWA/ANSI Standard C600 for Installation of Ductile Iron Water Mains and their Appurtenances.
- (h) AWWA Standard C651 for Disinfecting Water Mains.
- (i) NSF standards for all materials used in the production of potable water pipe.

- xx. SUBMITTALS. The Contractor shall submit the following information prior to beginning the work:

- (a) Manufacturers' certified data for each pipe type to be used on the project, including dimensions, specifications of pipe material, gasket material, pipe class/pressure rating, coatings, and linings.
- (b) Manufacturers' certified data for each type of fitting to be used on the project, including dimensions, specifications of fitting material, gasket material, class/pressure rating, coatings, linings, joint restraints, and appurtenances.
- (c) Manufacturers' certified data for the bridge mounted pipe supports, insulation, jacketing, heat trace, and

appurtenances.

- xx. QUALITY ASSURANCE. The Contractor shall be thoroughly trained and experienced in the skills and equipment required for installation and testing of water piping and appurtenances.

The Contractor shall protect water piping materials before, during and after installation. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Engineer and Owner at no additional cost to the Owner.

Upon direction of the Engineer, the Contractor shall remove, replace and/or rework all water piping and appurtenances that do not meet the requirements of this Section. The Contractor shall perform all remedial measures at no additional cost to the Owner.

- (a) Water System Pressure and Leakage Testing. Water system pressure and leakage testing shall be subject to the following requirements:

- (1) Engineer and Owner shall witness all testing.
- (2) Flush all piping prior to performing pressure testing.
- (3) Provide proper thrust restraint for all fittings and valves.
- (4) Test equipment shall have pressure relief valves so that water system components are not over-pressurized.
- (5) The pressure and leakage test shall include all services. The Contractor shall provide temporary "tails" as necessary to allow air to be bled from each service to above grade.
- (6) The pressure and leakage tests shall be performed as a combined hydrostatic test with a duration of two hours at 150% of the normal operating pressure in the piping at the lowest elevation or 200 psi, whichever is greater. The test pressure shall not exceed manufacturer recommendations for any portion of the system.
- (7) No water system components will be accepted if the test pressure cannot be maintained within 5 psi of the required pressure for the entire test period.
- (8) Leakage is defined as the quantity of water that must be supplied into the piping to maintain the test pressure after the pipe has been filled with water and the air expelled.
- (9) No water system components will be accepted if the leakage is greater than that determined by the

following formula:

$L = (SD / P) / (144,800)$  where

L = the allowable leakage in gallons per hour;  
S = the length of pipe being tested;  
D = the nominal diameter of the pipe in inches;  
P = the average test pressure in psi (gauge).

- (10) The Contractor shall make all repairs or replacements necessary to obtain passing test results, at no additional expense to the Owner.
- (11) The maximum length of pipe to be pressure and leakage tested at one time shall not exceed 1,200 feet. The Contractor shall provide all necessary temporary connections, valves, and piping to allow proper expulsion of air and connection of test equipment, at no additional cost to the Owner.
- (b) Heat Trace Testing. Heat trace testing shall be subject to the following requirements:
  - (1) The electric heat trace system shall be fully tested by the Contractor, according to the manufacturer's recommendations.
  - (2) Engineer and Owner shall witness all testing.

xx. MATERIALS.

- (a) Water Piping.
  - (1) Refer to Plans for locations and sizes of various pipe types required.
  - (2) Ductile Iron (DI) Water Pipe shall meet the referenced standards and the following requirements, as applicable:
    - a. Pipe shall be Pressure Class 350.
    - b. Pipe shall be cement mortar lined and seal coated.
    - c. Pipe shall be coated on the outside with bituminous coating.
    - d. Mechanical Joint pipe, where indicated on the Plans, shall be installed with mechanical joint restraints.
    - e. Restrained Push-On Joint pipe, where indicated on the Plans, shall be "Field Lock" Gasket System restrained push-on joint type, as manufactured by U.S. Pipe & Foundry Co.

- f. Pipe shall be furnished in 18 to 20 foot laying lengths.
  - g. Pipe shall be installed with three bronze conductivity wedges per joint.
  - h. Pipe shall be manufactured by Atlantic States Pipe Company, Clow, U.S. Pipe, Griffin, or McWane Pipe Company.
- (3) Each pipe length shall be clearly marked with the manufacturer's name or trademark, nominal pipe size, material designation, pressure class, dimensional ratio (DR), quality control code, and AWWA/ASTM designations.
  - (4) Restrained Pipe Joints shall be furnished and installed for the required number of joints back from each fitting, as required by the Plans and details, regardless of the pipe material type.
- (b) Fittings.
- (1) Ductile Iron fittings shall be Class 350 compact style with restrained mechanical joints with tee bolts as recommended by the manufacturer. Fittings, glands, and gaskets shall be of appropriate style and size for the pipes being connected.
  - (2) Fittings shall be cement mortar lined and seal coated.
  - (3) Fittings shall be coated on the outside with bituminous coating.
  - (4) All mechanical joint fittings for DI and PVC pipe shall have Mega-Lug mechanical joint restraints as manufactured by EBAA Iron Sales, Inc., or "Uni-Flange Wedge Action" mechanical joint restraints as manufactured by Ford Meter Box Co., of the proper style for the pipe type being restrained.
  - (5) All couplings shall be restrained mechanical joint solid sleeves with ductile iron long body and ductile iron glands. Sleeves, glands, and gaskets shall be of appropriate style and size for the pipes being connected.
  - (6) Thermal expansion joint shall be EBAA Iron Works "Extend 200 #208-M1", the equivalent manufactured by Ford Meter Box Company, or approved equal.
- (c) Pipe Insulation.
- (1) The pipes shall be insulated with a factory installed, void free, urethane insulation process, with an integral conduit for electrical heat trace

cable and a factory applied jacket by Urecon Pre-Insulated Pipe, the equivalent manufactured by Insul-Tek, or approved equal. System Service Temperature Range: -49<sup>0</sup>F to +185<sup>0</sup>F.

- (2) Pipe insulation shall be 2 inch thick urethane insulation. Insulated pipe shall be installed with a 0.175 inch, UV resistant, high density polyethylene (Type III, Category 5, Class C, Grade P34 resin) jacket as supplied and installed by the insulation manufacturer.
  - (3) Form fitting insulation and jacket kits shall be used to field insulate jacket bends and other fittings, according to manufacturer's recommendations.
  - (4) Insulated pipe joints shall be completed with the use of pre-fabricated urethane half shells and a pre-rolled sheet stock of the same material and gauge as the outer jacket.
  - (5) Bearing plates, as recommended by the insulation manufacturer, shall be installed at all pipe hangers.
  - (6) Electric heat tracing cable shall be Urecon "THERMOCABLE" (Model No. C20-240-COJ), the equivalent manufactured by Insul-Tek, or approved equal. Cable shall be constant watt, cut-to-length, parallel resistance heating strip which uses a thermally stable nichrome heating wire with a series of heating zones. Heating zones shall produce constant, predictable wattage per meter output. Cable shall be suitable for pulling into trace conduits on pre-insulated pipe systems.
- (d) Material Storage and Handling. Material storage and handling shall be performed in accordance with the following requirements:
- (1) Handle and transport pipe and fittings to insure they are in sound, undamaged condition and to prevent damage to coating and lining, in accordance with manufacturer's instructions.  
  
Furnish slings, straps, and other devices to support pipe and fittings when lifted. Do not drop or drag pipe or fittings from trucks onto the ground or into the trench.
  - (2) Examine all pipe and fittings before installing. Defective or damaged materials shall be rejected.
  - (3) Pipe or fittings with damaged coatings and/or linings shall be rejected.
  - (4) Cracked or chipped pipe or fittings shall be rejected.

- (5) If defective pipe or fittings are discovered after installation, the Contractor shall remove and replace the defective piece(s) at no additional cost to the Owner.

xx. GENERAL CONSTRUCTION REQUIREMENTS.

- (a) Installation. Installation shall be performed in accordance with the following requirements:

- (1) Water mains and appurtenances shall be installed according to the Plans.
- (2) Pipe shall be laid accurately to the lines and grades indicated on the Plans.
- (3) All field cut pipe ends shall be chamfered to avoid damage to the gasket and facilitate assembly. When cutting of pipe is required, the cutting shall be done with power saws. Cut ends shall be smooth and at right angles to the pipe. Cut pipe ends shall be beveled and de-burred on interior and exterior.
- (4) Push-on bell and spigot type joints shall be assembled per the manufacturer's recommendations.
- (5) Deflection of push-on joint pipe shall not exceed manufacturer's recommended limits.
- (6) Restrained Push-On Joints shall be assembled per the manufacturer's recommendations.
- (7) Restrained Mechanical Joints shall be assembled per the manufacturer's recommendations.
- (8) All fittings shall be adequately supported to prevent undo strain on the pipe, fittings, gaskets, and bolts.
- (9) Plant batched, poured in place, concrete thrust blocks shall be provided at all directional changes of the main, when restrained pipe joints cannot be used (i.e. connections to existing systems) in compliance with the Plans. Thrust blocks shall not be backfilled within ½ hour of being poured to allow sufficient time for setting of the concrete. Onsite mixed concrete is not acceptable.
- (10) When pipe laying is not in progress, the open ends of the pipe shall be closed with a water tight plug.
- (11) Where water mains cross within 2 feet of drainage pipe or site conditions do not allow the minimum 5½ foot cover, the Contractor shall install 2 inch thick by 2 foot wide rigid insulation, suitable for direct burial, for frost protection.

- (12) Cover of less than 5½ feet shall be approved by the Engineer prior to pipe installation. Under no circumstances shall water mains have less than 4 feet of cover over the top of the pipe, except where indicated on the Plans. Insulation shall be installed 6 inches above the pipe on compacted envelope material with care taken to not damage the sheets during trench backfill and compaction.
  - (13) Where water mains are required to cross wastewater piping, the installation shall comply with the following requirements:
    - a. Water and sewer pipes shall have a minimum vertical clearance of 18 inches.
    - b. Water and sewer pipe joints shall be located as far apart as possible.
    - c. The Contractor shall provide structural support for exposed water and sewer lines.
  - (14) The minimum horizontal clearance between water and sanitary sewer piping is 10 feet, and the minimum horizontal clearance to storm sewers is 5 feet.
  - (15) In the event that the minimum vertical or horizontal clearances between water and sewer piping cannot be maintained, the sewer piping must be upgraded and tested to water pipe standards.
  - (16) Pipe insulation shall be installed on the water line as shown on the Plans. All overlaps at the joints and fittings shall be 2 inch minimum and shall be field positioned in such a way as to shed water. All exposed ends of insulation shall be coated with an approved waterproofing sealant, as recommended by the supplier, after field cutting or trimming has been carried out.
  - (17) Heat Trace System.
    - a. Heat trace system, including heat trace cable and all appurtenances shall be installed according to the manufacturer's recommendations.
    - b. Heat trace temperature sensors shall be secured as recommended by the manufacturer with aluminium foil adhesive tape as supplied by the manufacturer.
- (b) Flushing. Flushing shall be performed in accordance with the following requirements:
- (1) All water piping shall be flushed at a minimum

velocity of 2.5 feet per second. All pipes shall be flushed prior to leakage and pressure testing, disinfection, and bacteriological testing.

- (2) Care shall be taken to protect property from erosion or other damage during flushing operations.
  - (3) The flushing operation shall include all services.
- (c) Disinfection. Disinfection shall be performed in accordance with the following requirements:

- (1) At a point not more than 10 feet downstream from the beginning of a new main, water entering the main shall be dosed with chlorine, fed at a constant rate, such that the entire volume of water will have a concentration of not less than 25 mg/l free chlorine. Chlorine levels shall be confirmed with a test kit; however, the following table is provided as a general guide to estimate the volume of chlorine required.

PIPE SIZE (INCHES)	1% CHLORINE SOLUTION (GALLONS)
4	0.16
6	0.36
8	0.65
12	1.44

Chlorine required to produce 25 mg/l concentration in 100 feet of pipe, by pipe diameter.

- (2) Disinfection operations shall not cease until the entire main is filled with heavily chlorinated water.
- (3) The chlorinated water shall be retained for a minimum of 24 hours, during which all curb stops, valves, and hydrants in the treated section shall be operated to ensure disinfection of appurtenances. The water in all portions of the main shall have a minimum residual of 10 mg/l of free chlorine after 24 hours.
- (4) The Contractor shall prevent the introduction of heavily chlorinated water into any active portions of the water distribution system.
- (5) At the end of the 24 hour period, the main shall be flushed with water from the distribution system until the discharge chlorine concentration is equal to that of the system or 1 mg/l free chlorine.
- (6) The Contractor shall comply with all laws relevant to the discharge of chlorinated water. Water discharged directly or indirectly to water bodies shall not have

a chlorine level greater than 0.1 ppm. Water bodies shall include all rivers, streams, creeks, brooks, reservoirs, ponds, lakes, springs, wetlands, and any body of surface water, artificial or natural.

- (7) The Contractor shall supply all necessary de-chlorination equipment, materials, chemicals, and labor necessary to reduce the chlorine level prior to discharge.
- (8) Any required permits for the discharge of chlorinated water (local or State) are the responsibility of the Contractor.

xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Water Main on Bridge) to be measured for payment will be on a unit basis for each water main installation on a bridge performed in the complete and accepted work.

The quantity of Special Provision (Electric Heat Trace System) to be measured for payment will be on a unit basis for each electric heat trace system installed in the complete and accepted work.

xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Water Main on Bridge) will be paid for at the Contract lump sum price. Payment will be full compensation for furnishing, transporting, handling, and installing the materials specified; all appurtenant work and materials necessary for a complete installation, including but not limited to pipe, fittings, joint restraints, expansion joints, insulation, jacket, heat trace cable, pipe supports, and disinfecting and testing the water main system; for making all necessary connections; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

The accepted quantity of Special Provision (Electric Heat Trace System) will be paid for at the Contract lump sum price. Payment will be full compensation for furnishing and installing the heat trace sensor and appurtenances; testing the system; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work. Payment for heat trace cable will be paid separately under Contract item 900.645 Special Provision (Water Main on Bridge).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.645 Special Provision (Electric Heat Trace System)( <b>Bridge No. 36</b> )( <b>for multiple bridges</b> )	Lump Sum
900.645 Special Provision (Water Main on Bridge) ( <b>X</b> MM)( <b>X</b> " )	Lump Sum