

**SECTION 33 10 00
CHILLED WATER UTILITIES**

PART 1 - GENERAL

1.1 DESCRIPTION:

Underground chilled water distribution system complete, ready for operation, including all appurtenant structures, and connections to both new building service lines and to existing water supply.

1.2 RELATED WORK:

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: Section 31 20 00, EARTH MOVING.
- C. Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- D. Protection of materials and equipment: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 DEFINITIONS:

- A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of new chilled water piping systems.
- B. Water Service Line: Pipe line connecting building piping to chilled water distribution lines.

1.4 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be product of one manufacturer.
 - 2. Nameplate: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data (Submit all items as one package): (Ductile Iron Pipe and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively; and shall be provided to Resident Engineer for approval.)
 - 1. Piping.

- 2. Gaskets.
- 3. Valves.
- 4. Vaults, frames and covers.
- 5. Steps.
- 6. Valve boxes.
- 7. Joint restraint.
- 8. Link/sleeve seals.
- C. Testing Certifications:
 - 1. Hydrostatic Testing.

1.6 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI/ASME):
 - B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings
 - B40.100-98.....Pressure Gauges and Gauge Attachments
- C. American Society for Testing and Materials (ASTM):
 - A123-97.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A148M-03.....Standard Specifications for Steel Castings
 - A242-00.....Standard Specifications for High Strength Low Alloy Structural Steel AASHTO No. M161
 - A307-02.....Standard Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - A536-04.....Standard Specifications for Ductile Iron Castings
 - B61-02.....Steam or Valve Bronze Castings
 - B62-02.....Composition Bronze or Ounce Metal Castings
 - C32-04.....Sewer and Manhole Brick (Made from Clay or Shale)
 - C139-03.....Concrete Masonry Units for Construction of Catch Basins and Manholes
 - D1784-03.....Standard Specifications for Rigid PVC Compounds and CPVC Compounds
 - D2464-99.....Standard Specifications for Threaded PVC Pipe Fittings, Schedule 80

- D2467-02.....Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- D3139-98.....Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- F477-02e1.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- D. American Water Works Association (AWWA):
- C104-04.....Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
- C105-99.....Polyethylene Encasement for Gray and Ductile C.I. Piping for Water and Other Liquids
- C110-03.....Ductile-Iron and Gray-Iron Fittings, 80 mm (3 Inches) Through 1200 mm (48 Inches) for Water and Other Liquids
- C111-01.....Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
- C115-99.....Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
- C150-02.....American National Standard for Thickness Design of Ductile Iron Pipe
- C151-96.....Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
- C153-00.....Ductile-Iron Compact Fittings, 80 mm (3 inches) Through 300 mm (12 Inches) for Water and Other Liquids
- C500-02.....Gate Valves for Water and Sewerage Systems
- C509-01.....Resilient Seated Gate Valve for Water and Sewage System
- C550-01.....Protective Epoxy Interior Coatings for Valves and Hydrants
- C600-01.....Installation for Ductile-Iron Water Mains and Their Appurtenances
- C605-94.....Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- C800-01.....Underground Service Line Valves and Fittings

C900-97.....Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches
Thru 12 Inches, for Water

C905-97.....Polyvinyl Chloride (PVC) Pressure Pipe 14 Inches
Thru 36 Inches

E. NSF International:

14-03.....Plastics Piping Components and Related Materials

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting
Industry, Inc.:

SP-67-02a.....Butterfly Valves

SP-70-06.....Gray Iron Gate Valves, Flanged and Threaded Ends

PART 2 - PRODUCTS

2.1 PRE-INSULATED POLYVINYL CHLORIDE PIPE AND FITTINGS:

A. Class-Rated Polyvinyl Chloride (PVC) Pipe:

1. PVC pipe and accessories 100 mm to 356 mm (4 inches-14 inches) in diameter, AWWA C900 "Polyvinyl Chloride (PVC) Pressure Pipe", Class 160, SDR 26, with polyurethane foam insulation and jacketed by High Impact PVC Class 12454-B Compound (ASTM 1784, Type 1, Grade 1) sealable jacketing, unless otherwise shown or specified.
2. Pipe to be provided with a minimum 1.46-inch thick for 12-in. pipe, 1.64-in. thick for 10-in. pipe, polyurethane foam insulation or equivalent surrounding the pvc carrier pipe. Insulation characteristics: K factor= .13, Density 2 pounds per cubic foot, Closed cell content 90-95% in conformance with MIL-I-24172 and ASTM C-591.
3. Jacket of the piping system to be PVC of minimum 160 mills thick for 12-inch mains, 140 mills for 10-in. mains.

B. Joints:

1. Pipe 75 mm (3 inches) and Greater in Diameter: Push-on type with factory installed solid cross section elastomeric ring meeting the requirements of ASTM F-477.

C. Fittings:

1. Solvent weld or gasket couplings, bell and spigot with rubber ring gasket seals.
2. PVC of the same type and grade material as the piping, rated for the same temperature and pressure.
3. All fittings to be be uninsulated to permit proper thrust-blocking.

2.3 VALVES:

- A. Asbestos packing is not allowed.
- B. Gate:
 - 1. 75 mm (3 inches) and Larger: Resilient seated, ductile iron body, bronze mounted, inclined seats, non-rising stem type turning counter-clockwise to open, 1375 kPa (200 pound) WOG. AWWA C509. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550.
 - 2. Operator:
 - a. Underground: Furnish valves with 50 mm (2 inch) nut for socket wrench operation. Post indicator shall comply with the requirements of NFPA 24 and shall be fully compatible with the valve provided.
 - b. Above Ground and in Pits: Hand wheels.
 - 3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.
- C. Butterfly (inside vaults and in crawl-spaces): (Pipe Sizes 2-1/2" and larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS-SP 67, flange lug type or grooved end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure.
 - 1. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
 - 2. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.
 - 3. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.
 - a) Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.

- b) Valves 200 mm (8 inches) and larger: Enclosed worm gear with handwheel, and where required, chain-wheel operator.

2.4 VALVE BOX:

Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be adapted, without full extension, to depth of cover required over pipe at valve location. Cast the letters "CHWS (or R for return) in cover. Provide two (2) "T" handle socket wrenches of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

2.5 PIPE SLEEVES:

Ductile iron or zinc coated steel.

2.6 VAULTS/MANHOLES:

- A. Concrete Construction: Top and base shall be reinforced concrete conforming to Section 03 30 00, CAST-IN-PLACE CONCRETE, not less than 200 mm (8 inches) thick. Pour monolithically where possible. Walls shall be reinforced concrete or precast concrete of similar thickness and construction. Place waterproof membrane as specified in Section 07 12 00, BUILT-UP BITUMINOUS WATERPROOFING, between mud slab and bottom concrete slab, and continue up sides to top of sidewalls. Joints between manhole walls and conduit casings or concrete trench sections shall be watertight. Steel manholes or prefabricated concrete manholes are not permitted.
- B. Manhole Access Frames, Covers and Steps: Provide each manhole with cast iron manhole frames and solid covers, not less than 700 mm (28 inch) clear openings, Fed. Spec. A-A-60005. Unless otherwise shown on the drawings, frames and covers shall be as follows:
1. For non-traffic applications:
 - Frame - Type IV, Size 28
 - Cover - Type E, Size 28, cast identification "STEAM".
 2. For traffic applications:
 - Frame - Type I, Style A, Size 27A
 - Cover - Type A, Size 27A, cast identification "STEAM".
 3. Manhole steps: Standard, cast-iron, Fig. 19, Fed. Spec. A-A-60005.
- C. Ventilation: Provide manhole ventilation as indicated on drawings. Gravity ventilators shall be factory fabricated of aluminum or galvanized steel and arranged as indicated on drawings.

- D. Drainage: Provide as shown on drawings. Provide a 610 mm (24 inch) square by 610 mm (24 inch) deep sump pit in each manhole where indicated on drawings. Provide larger sump pit if necessary to accommodate required electric sump pumps.
- E. Electric Sump Pumps with Automatic Controls and High Water Alarm:
1. Type: High temperature submersible duplex pumps and automatic controls.
 2. Service: Continuous operation at required flows and pressures while completely submerged at 93 °C (200 °F). All pumps and pump controls shall have demonstrated 200,000 cycles of operation at 93 °C (200 °F) and 100% relative humidity while totally submerged in water.
 3. Performance: Capacity and pressure as required by the drawings. Pumps shall be capable of passing 10 mm (0.375 inch) spheres. Pumps and motors shall be capable of operating continuously without damage when not submerged.
 4. Construction: Epoxy-coated cast iron casing, cast iron impeller, stainless steel shaft, carbon/ceramic shaft seal, stainless steel hardware, permanently lubricated bearings, screened inlets. Schedule 80 discharge pipe protected from corrosion.
 5. Motors: Non-overloading at all points on the pump performance curve. Overload protection.
 6. Controls: Automatic alternating lead-lag. Damp-proof electrical service.
 7. High Water Alarm: Switch set at level below lowest steam or condensate pipe in the manhole. Switch shall activate weatherproof red alarm light mounted above grade as shown. Provide contacts // for future connection to engineering control center.
 8. Pump Manufacturers: Barnes, Zoeller, or equal.

2.7 WARNING TAPE

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable nontype, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

PART 3 - EXECUTION

3.1 BUILDING SERVICE LINES:

Install chilled water service lines into the buildings identified and provide PVC flange and gasketed to match interior steel welded piping. .

3.2 PIPE LAYING, GENERAL:

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Resident Engineer.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Government. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.
- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joint is being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- J. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. See section 3.7 "PIPE SUPPORTS".
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.

- M. Warning tape shall be continuously placed 300 mm (12 inches) above buried water pipes.

3.3 PVC PIPE:

- A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and thoroughly compacted to one foot above the top of the pipe and thereafter back filled as specified in Section 31 20 00, EARTH MOVING.
- B. Copper Tracer Wire: Copper tracer wire consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder. The solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.
- C. Magnetic markers may be used in lieu of copper tracer wire to aid in future pipe locating. Generally, install markers on 6 m (20 foot) centers. If pipe is in a congested piping area, install on 3 m (10 foot) centers. Prepare as-built drawing indicating exact location of magnetic markers.

3.4 PIPE SUPPORTS:

- A. Supports:
1. All piping shall be properly and adequately supported. Hangers, supports, base elbows and tees, and concrete piers and pads shall be provided as indicated on the drawings. If the method of support is not indicated on the drawings, exposed piping shall be supported by hangers wherever the structure is suitable and adequate to carry the superimposed load. Supports shall be placed approximately 2.4 m (8 feet) on centers and at each fitting.
 2. Hangers shall be heavy malleable iron of the adjustable swivel type, split ring type, or the adjustable-swivel, pipe-roll type for horizontal piping and adjustable, wrought iron, clamp type for vertical piping. Flat steel strap or chain hangers are not acceptable unless indicated on the drawings.

3. Hangers shall be attached to the structure, where possible, by beam clamps and approved concrete inserts set in the forms before concrete is poured. Where this method is impractical, anchor bolts with expanding lead shields, rawl drives, or malleable iron expansion shields will be permitted.
4. Where hangers cannot be used, the Contractor shall provide pipe saddle supports with pipe column and floor flange.

3.5 RESTRAINED JOINTS:

- A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "locked-type" joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 1375 kPa (200 psi). The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.
- B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be as shown on the drawings.
- C. PVC pipe bell and spigot joints shall be restrained with the Uni-Flange Corp. Series 1350 Restrainer or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.
- D. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with UNI-Flange Corp. Series 1300 Restrainer, EBBA Iron, Inc, Series 2000PV Mechanical Joint Restrainer Gland, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

3.6 PIPE SEPARATION:

- A. Horizontal Separation-Chilled Water Mains and Sewers:
 1. Chilled Water mains shall be located at least 3 m (10 feet) horizontally from any proposed drain, storm sewer, sanitary or sewer service connection.

2. Chilled Water mains may be located closer than 3 m (10 feet) to a sewer line when:
 - a. Local conditions prevent a lateral separation of 3 m (10 feet); and
 - b. The water main invert is at least 450 mm (18 inches) above the crown of the sewer; and
 - c. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located one side of the sewer.
3. When it is impossible to meet (1) or (2) above, both the chilled water main and drain or sewer shall be constructed of mechanical joint ductile iron pipe. Ductile iron pipe shall comply with the requirements listed in this specification section. The drain or sewer shall be pressure tested to the maximum expected surcharge head before back filling.

B. Vertical Separation-Chilled Water Mains and Sewers:

1. A chilled water main shall be separated from a sewer so that its invert is a minimum of 450 mm (18 inches) above the crown of the drain or sewer whenever water mains cross storm sewers, sanitary sewers or sewer service connections. The vertical separation shall be maintained for that portion of the water main located within 10 feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
2. A vertical separation of 450 mm (18 inches) between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and breaking the water main.
3. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least 3 m (10 feet).

3.7 SETTING OF VALVES AND BOXES:

- A. Provide a surface concrete pad 450 by 450 by 150 mm (18 by 18 by 6 inches) to protect valve box when valve is not located below pavement.
- B. Clean valve box interior before installation.
- C. Set valve and box cover flush with finished grade.
- D. Valves shall be installed plumb and level and in accordance with manufacturer's recommendations.

3.8 PIPE SLEEVES:

Install where chilled water lines pass through retaining walls, building foundations, vaults and floors. Seal with modular mechanical type link seal. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

3.10 HYDROSTATIC TESTING:

- A. Hydrostatic testing of the system shall occur as required during construction to verify the integrity of the piping systems prior to burial. As each zone of piping is completed perform a hydrostatic test for the installed piping and re-test once the entire system is completed.
- B. After new system is installed, except for connections to existing system and building, backfill at least 300 mm (12 inches) above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.
- E. The Contractor shall install air vents in the line as required to purge the air out of the system. At the completion of the test, all air vents shall be closed.
- F. The Contractor shall perform pressure and leakage tests for the new system for 2 hours to 1031 kPa (150 psi) with no leakage.

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