

## SECTION 02708

### PRESSURE PIPELINES AND APPURTENANCES

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Furnish, install and test all items appurtenant to pressure pipeline systems
  - 1. Disinfect all potable water pipelines
- B. Additional Requirements Specified Elsewhere
  - 1. Section 01010: Summary of Work
  - 2. Section 01340: Shop Drawings, Product Data, and Samples
  - 3. Section 01400: Quality Control
  - 4. Section 01600: Material and Equipment
- C. Related Requirements Specified Elsewhere
  - 1. Section 02200: Earthwork
  - 2. Section 02615: Ductile Iron Pipe
  - 3. Section 02616: Stainless Steel Pipe
  - 4. Section 02617: Steel Pipe
  - 5. Section 02622: Plastic Pipe
  - 6. Section 02623: High-Density Polyethylene Pipe
  - 7. Section 02641: Valves and Accessories
  - 8. Section 03410: Precast Concrete
  - 9. Section 09900: Painting
  - 10. Section 13300: Utility Control System
  - 11. Section 15060: Pipe and Pipe Fittings
  - 12. Construction Standards: Thrust Blocks

##### 1.2 QUALITY ASSURANCE

- A. Allowable Tolerances
  - 1. Horizontal alignment:  $\pm 0.5'$
  - 2. Vertical alignment:  $\pm 0.2'$
  - 3. Maintain inverts as indicated on the Drawings at all structures

##### 1.3 SUBMITTALS

- A. Shop drawing and product data in accordance with Section 01340
  - 1. Material specification data
  - 2. General piping layout and laying schedule including all appurtenances
  - 3. Installation instructions

- B. Test Reports: Reports of Field Tests
- C. Certification of Compliance
  - 1. Manufacturer's affidavit of compliance certifying
    - a. All materials comply with applicable standards
    - b. All materials comply with these Specifications

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Carefully handle, store and protect all pipe, fittings, valves and appurtenances to protect materials and protective coatings and linings
- B. Remove any damaged or defective materials from the construction site and replace at no additional expense to the Owner
- C. Under no circumstances shall materials be dumped or dropped into the trench
- D. Handling
  - 1. Use wide belt slings and wide padded skids
  - 2. Bar cables, hooks, metal bars, or narrow skids shall not be permitted to come in contact with coating or lining
  - 3. Do not drop pipe or fittings
  - 4. Do not roll, skid, or otherwise move pipe or fittings when in contact with ground at any point

#### 1.5 JOB CONDITIONS

- A. Protection
  - 1. Prevent foreign material from entering pipe, fittings, valves and appurtenances during installation
    - a. Do not place debris, tools, clothing or other material in pipe
  - 2. Coordinate material delivery closely with installation to minimize the possibility of contamination
  - 3. Whenever pipe installation is stopped, seal open end of pipe with watertight plug to prevent trench water, debris or other material from entering the pipe
    - a. Take adequate measures to prevent flotation
    - b. If water is present in trench, leave seal in place until trench is pumped dry
- B. Unsuitable Conditions
  - 1. No pipe shall be installed when, in the opinion of the Engineer, trench or weather conditions are unsuitable

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Pipe

1. Ductile iron pipe: Refer to Section 02615
2. Steel pipe: Refer to Section 02617
3. PVC pipe: Refer to Section 02622
4. HDPE pipe: Refer to Section 02623
5. Small diameter pipe requirements: Refer to Section 15060

#### B. Fittings

1. Refer to Section 02615 - Ductile Iron Pipe
2. Refer to Section 02617 for steel fittings
3. Refer to Section 02622 for Schedule 80 and 40 PVC fittings
4. Refer to Section 02623 for HDPE fitting requirements
5. Refer to Section 15060 for small diameter pipe fitting requirements

#### C. Valves

1. Refer to Section 02641 - Valves and Accessories

#### D. Valve Boxes (For use on Valves 3-Inch and Larger)

1. Material: Cast iron
2. Size: 5" diameter, minimum
3. Type: Adjustable screw type
4. Cover: Deep socket type with the word "WATER", "NONPOTABLE", "BLANK", or "SEWER" cast in top as appropriate
5. Design basis: Tyler slip type 6-inch cast iron valve box assembly, Series 6855 or equal

#### E. Valve Boxes (For use on Valves Under 3-Inch Size)

1. Material: Cast iron
2. Size: 2½-inch diameter shaft (nominal)
3. Type: Adjustable screw type
4. Cover: Cast iron, with locking screw and word "WATER", "NONPOTABLE", "BLANK", or "SEWER" cast in top as appropriate
5. Base: Arch type, properly sized for valve or curb stop

#### F. Concrete

1. Thrust blocks and encasements: Per Section 03300

#### G. Manholes

1. Precast manholes and appurtenances in accordance with Section 02709

- a. PVC membrane lining system and epoxy coating system not required on dry pit type manhole installations

#### H. Solid Sleeve

1. Install where noted on Drawings
2. Conformance: ANSI/AWWA C153/A21.53 or ANSI/AWWA C110/A21.10

#### I. Mechanical Coupling

1. Applications
  - a. Mechanical couplings to joint two pipes of the same O.D. dimension
  - b. Transition couplings to joint two pipes of different nominal size, material and/or O.D. dimension
2. Type: Bolted, mechanical compression sleeve type
3. Conformance: AWWA C219
4. Material: Ductile iron ASTM A536
5. Gaskets
  - a. Styrene Butadiene rubber compound for water and sewer service
  - b. Sized to match O.D. dimension of each pipe
  - c. Marked with manufacturer's standard code for couplings/gaskets of different pipe types and O.D. dimensions
6. Coatings: Fusion bonded epoxy
7. Acceptable manufacturers
  - a. Romac Industries, Inc.
  - b. Dresser Industries
  - c. Or equal

#### J. Flanged Coupling Adapter

1. Design basis: EBAA Iron Sales, Inc., Series 2100 MegaFlange®

#### K. Flange Adapters

1. EBBA Iron Sales, Inc., Series 1000 E-Z Flange Adapter
2. Ford Meter Box Company, Inc., Series 200 Uni-Flange® Adapter Flange
3. Or approved equivalent

#### L. Joint Restraints

1. Application
  - a. C900 PVC pipe to mechanical joint fitting: EBAA Iron Series 2000 PV Megalug® mechanical joint restraint
  - b. IPS O.D. PVC pipe to mechanical joint fitting: EBAA Iron Services 2000 PV Megalug® mechanical joint restraint
  - c. C905 PVC pipe to mechanical joint fitting: EBBA Iron Series 2000 PV Megalug® mechanical joint restraint
  - d. C900 PVC pipe bell restraint: EBAA Iron Series 1500
  - e. C905 PVC pipe bell restraint: EBAA Iron Series 2800
  - f. IPS O.D. PVC pipe bell restraint: EBAA Iron Series 6500
  - g. Ductile iron pipe bell restraint: EBAA Iron Series 1700

- h. Restrained flange adapter: EBAA Iron Series 2100 MegaFlange®
- i. Mechanical joint restraint: EBAA Iron Series 2000 Megalug®
- j. Flange joint restraint: EBAA Iron Series 1000 E-Z Flange Adapter
- k. Field assembled restraints
  - 1) Harnesses: Romac Industries, Inc. Ductile Lugs or 90° Eye Bolts, or equivalent
  - 2) Tie rods
    - a) ASTM A307 minimum grade all-thread
    - b) Cadmium plated
    - c) Minimum diameter: ¾-inch
- 2. Location: Where required on the Drawings
- 3. Substitution for thrust blocks subject to Engineer's review and approval
- 4. Or approved equivalent

M. Ultra-Compact MJ Restraint

- 1. Design basis: Infact Corporation; Foster Adaptor bolt-thru mechanical joint restraint

N. Gaskets

- 1. All mechanical joint, flange and O-ring gaskets used on air piping must be suitable material rated for a minimum 300°F continuous service temperature

O. Utility I.D. Posts

- 1. Lightweight non-metallic post manufactured from thermosetting composite material consisting of marble, thermosetting polymers and glass fibers
  - a. Tensile strength: 50,000 psi
  - b. Compressive strength: 45,000 psi
  - c. Weight: 0.33 lbs/ft minimum
  - d. Temperature stability: -50°F to 200°F
  - e. Length: 6'
  - f. Width: 4"
  - g. Soil embedment: 24" minimum
  - h. Install with tools as recommended by manufacturer; installation tools shall become the property of the Owner at completion of the project
  - i. Color
    - 1) Purple for use on nonpotable water hydrants and building service curb stops
    - 2) Colors for other utilities, fixtures, etc., as indicated on the Drawings
- a. Carsonite Companies, LLC, Utility Marker® or equivalent
- 2. Decals
  - a. Location: On all nonpotable exterior hydrants including yard hydrants
    - 1) Markings: Nonpotable Water Do Not Drink
    - 2) Dual colored: White on purple
  - b. Location: On all nonpotable water building service curb stops not in roadways
    - 1) Markings: Nonpotable Water Valve
    - 2) Dual colored: White on purple
  - c. As described on Drawings for other utilities, fixtures, etc.

P. Polyethylene Encasement Material

1. Conformance: AWWA Standard C105 polyethylene encasement for gray and ductile cast iron piping for water and other liquids
2. Material: Polyethylene film, Type I, Class A, Grade E-1 in accordance with ASTM standard designation D-1248
3. Thickness: 8 mils

Q. Tracer Wire

1. Material: #12 copper clad steel or #8 solid copper insulated tracer wire
2. Insulation: 45 mil high molecular weight polyethylene material, ASTM D1248-84
3. Insulation color: Purple
4. Volt rating: 30
5. Couplings: Compression type, non-corrosive, Burndy Crimpits No. VC10C10 or equivalent

R. Curb Box for use on Tracer Wire Access Locations

1. Type: Adjustable screw, cast iron curb box
2. Size: 2½-inch diameter (nominal)
3. Cover: Cast iron with locking screw and blank lid
4. Base: Arch patterned base
5. Length: As required
6. Intervals: To be installed a maximum of 400' apart unless otherwise noted on Drawings
7. Application: For tracer wire extensions to be brought to the surface for access

## 2.2 PIPE SCHEDULE

- A. Refer to Yard Piping Schedule on the Drawings for pipe type, service, test method and test pressure of all yard piping
- B. Refer to Section 15060 for domestic water, gas, drain and chemical feed piping
- C. Interior Piping Schedule and Test Pressure
  1. All interior piping that is connected to, or an extension of, exterior yard piping shall be tested to the same requirements given in the Yard Piping Schedule for the associated yard piping
  2. Refer to Interior Process Piping Schedules on Drawings for pipe type, service, test method and test pressure for process piping contained inside buildings
  3. Nonpotable water
    - a. Schedule 80 PVC pipe serving hose gates, pump seal water systems, flush/wash water systems, chemical feed systems, and other systems as indicated on the Drawings
    - b. Test medium: Water
    - c. Test pressure: 150 psi

## PART 3 - EXECUTION

### 3.1 PREPARATION

#### A. Verification

1. Verify dimensions and class of proposed pipe, valves, fittings and equipment prior to installation to ensure the piping system will fit together properly

#### B. Cleaning and Inspection

1. All pipe, fittings, valves and appurtenances shall be thoroughly cleaned of all foreign material and inspected for cracks, flaws or other defects prior to installation
2. Keep clean until work is accepted
3. Keep joint contact surfaces clean until joint is completed
4. Mark defective, damaged or unsound materials with bright marking crayons or paint and remove from jobsite
5. Review any damaged lining or coating with Engineer's representative to ascertain repair or replacement requirements

#### C. Site Preparation and Excavation

1. Refer to Section 02200 - Earthwork for requirements

### 3.2 INSTALLATION

#### A. Pipe Laying

1. Install pipe with bell ends facing the direction of laying unless otherwise authorized by Engineer
2. Where pipe is laid on a positive grade, the installation shall proceed uphill with the bell ends facing upgrade
3. Install pipelines such that a positive or negative grade is maintained between high and low points to avoid air pockets
  - a. High and low points are at locations indicated by the Drawings and are typically at structures
  - b. If intermediate high or low points are required due to construction techniques, install blow off assemblies at low points and air relief valve assemblies at high points in accordance with Construction Standards
4. As each length of pipe is placed in the trench, the joint shall be completed in accordance with the applicable portions of the pipe material specifications and the pipe brought to the correct line and grade
5. Secure the pipe in place with the specified embedment material placed and tamped under and around the pipe
6. Do not walk on small diameter pipe or otherwise disturb any conduit after jointing has been completed

7. Do not lay pipe
  - a. In water
  - b. Under unsuitable weather conditions
  - c. Under unsuitable trench conditions
8. Unless otherwise specified or indicated on the Drawings, the minimum depth of cover from finished grade to the top of the pipe shall be 6'

#### B. Concrete Encasement

1. Provide where indicated on the Drawings or where required by other sections of the Specifications
2. Suitably support and block pipe and anchor against flotation

#### C. Reaction Anchorage and Blocking

1. Provide thrust blocks, anchors, joint harness or other approved means to prevent separation of joints and pipe movement
  - a. In buried piping subject to hydrostatic heads in excess of 13 psi at
    - 1) Bends deflecting  $11\frac{1}{4}^{\circ}$  or more
    - 2) Push-on or mechanical joint caps or plugs
    - 3) Tees, crosses, reducers and valves
  - b. Other locations: Provide reaction blocking anchorages or other supports for fittings in fills, unstable ground or above grade as required to prevent movement and joint separation
2. Thrust blocks
  - a. Bearing area per Construction Standards, sized to accommodate the specified test pressure of the pipeline
  - b. Extend from fitting to solid undisturbed earth
  - c. Installed so joints are accessible for repair
  - d. If adequate support against undisturbed earth cannot be obtained, provide metal harness anchorages across the joint and secure by anchoring to the pipes or fittings or other anchorage facilities as required for adequate support
3. Joint harness
  - a. Provide joint harness or other supports for fittings installed in fills or other unsuitable soil, above grade or exposed within structures as required by the Drawings, as specified in other sections of the Project Manual or as necessary to prevent movement
4. Joint restraint
  - a. In locations authorized by Engineer
  - b. Flexibility of joint shall be maintained after burial
  - c. Install in accordance with manufacturer's recommendations

#### D. Protection of Metal Surfaces

1. Coat all ferrous metal rods, clamps, bolts and other accessories subject to submergence or contact with earth or fill material and not concrete encased
2. Apply two coats of coal tar epoxy or polyamide epoxy to clean, dry, metal surfaces
3. Allow first coat to dry and harden before applying second coat



4. Refer to applicable portions of the pipe material specifications for additional requirements
5. Where the ductile iron pipe is cut to fit field conditions, prepare bare metal surfaces in accordance with SSPC SP-10 and apply two coats of polyamide epoxy. Allow initial set/cure prior to assembly

E. Connections to Existing Pipelines

1. Field locate existing pipelines as required
2. Make connections between new work and existing piping using suitable fittings for the conditions encountered
3. Make each connection at a time and in a manner authorized by the Owner
4. The Owner will operate all valves. No valve or other control unit shall be operated for any purpose by the Contractor
5. Take all precautions to prevent contamination when making connections to the lines
6. No trench water, mud or other contaminating substances shall be permitted to enter the pipelines

### 3.3 INSTALLATION OF PIPELINE APPURTENANCES

A. General

1. Install all valves and other equipment appurtenant to the pipelines at locations indicated on the Drawings or as otherwise designated by the Engineer to accommodate field conditions
2. Record "as-built" measurements prior to backfill to reference all appurtenant equipment to the nearest permanent surface improvements or other coordinate point locations designated on the Drawings

B. Installation of Valves

1. Install valves in the pipeline in the same manner specified for laying and jointing the pipe
2. Install in accordance with details on Drawings and Construction Standards

C. Installation of Valve Boxes

1. Install valve boxes on all buried valves except where specified otherwise
2. Install such that no stress is transmitted from valve boxes to the valve
3. Set boxes plumb and directly over valve
4. Place top of box flush with finished grade in off road areas
  - a. ½" below finished grade in asphalt or paved areas, or their gravel shoulders
  - b. 6" below finish grade in gravel roadways
5. Backfill and compact around each box
6. Provide extended stems on valves where required such that the operating nut is not lower than 4' below finished grade

D. Construction of Manholes

1. See Section 02709 – Gravity Pipelines and Appurtenances

2. Installation, testing and inspection of PVC Sheet Liner and Protective Epoxy Coating system, where required, shall be in accordance with Section 02709
- E. Vent Structure Assemblies
1. In accordance with details on Drawings
- F. Installation of Utility I.D. Posts
1. Install as shown on the Drawings and specified herein
- G. Polyethylene Wrap for Fittings and Ductile Iron Pipe (NOT ANY AIR PIPE)
1. Place tube of polyethylene material on pipe, fitting or joint prior to lowering it into trench
  2. Pull tube over the length of the fitting and a minimum of 6" onto adjacent PVC pipe or a minimum of 6" onto the adjacent DI joint's tube. Tape tube to section of adjacent joint on both sides
  3. Use plastic adhesive tape to tape the polyethylene tubing onto the adjacent PVC or DI joints at no more than 6" intervals. Extend plastic adhesive tape a minimum of 6" onto polyethylene wrap and the adjacent PVC or DI piping
  4. See Construction Standard
- H. Installation of Tracer Wire
1. Secure tracer wire to plastic main piping with 1" wide appropriate plastic tape at 4' intervals
  2. Splice wire with compression type fittings to assure electrical continuity
  3. Secure tracer wire to all sides of each fitting
  4. Extend tracer wire to the ground surface at:
    - a. Curb boxes installed specifically for that purpose
    - b. Valve boxes
    - c. As otherwise directed by the Engineer or shown on the Drawings

### 3.4 FIELD QUALITY CONTROL

#### A. Hydrostatic Tests

1. All newly laid pipe or any valved section thereof shall be subjected to a pressure and leakage test
2. Contractor shall provide all pumps, pipe, connections, gauges, measuring devices and all other necessary apparatus
3. Conduct tests in the presence of and to the satisfaction of the Engineer

#### B. Test Pressure and Duration of Test

1. Minimum test pressure shall be as scheduled herein or on the Drawings measured at the low end of the pipeline
2. Maintain test pressure for a minimum 2 hours

#### C. Air Removal

1. Prior to performance of the test the pipeline shall be completely filled with water for a period of 72 hours
  - a. Utilize Owner-provided construction water supply for testing of pipeline
2. Expel air by means of air relief valves, hydrants or other means as required

D. Allowable Leakage

1. Allowable leakage is defined as the quantity of water that must be supplied to the test section to maintain the specified test pressure
2. Allowable leakage shall not exceed that determined by the following table

Allowable Leakage  
10 Gallons per Day per Inch of Pipe Diameter per Mile

1-inch Diameter Pipe	=	0.02 Gallons per 2 Hours per 100 Feet
2-inch Diameter Pipe	=	0.03 Gallons per 2 Hours per 100 Feet
3-Inch Diameter Pipe	=	0.05 Gallons per 2 Hours per 100 Feet
4-Inch Diameter Pipe	=	0.06 Gallons per 2 Hours per 100 Feet
6-Inch Diameter Pipe	=	0.09 Gallons per 2 Hours per 100 Feet
8-Inch Diameter Pipe	=	0.13 Gallons per 2 Hours per 100 Feet
10-Inch Diameter Pipe	=	0.16 Gallons per 2 Hours per 100 Feet
12-Inch Diameter Pipe	=	0.19 Gallons per 2 Hours per 100 Feet
14-Inch Diameter Pipe	=	0.22 Gallons per 2 Hours per 100 Feet
16-Inch Diameter Pipe	=	0.25 Gallons per 2 Hours per 100 Feet
18-Inch Diameter Pipe	=	0.28 Gallons per 2 Hours per 100 Feet
20-Inch Diameter Pipe	=	0.32 Gallons per 2 Hours per 100 Feet
24-Inch Diameter Pipe	=	0.39 Gallons per 2 Hours per 100 Feet
30-Inch Diameter Pipe	=	0.47 Gallons per 2 Hours per 100 Feet

E. Air Tests

1. Piping in several locations per the pipe schedules may be air tested in lieu of hydrostatically tested, Contractor's option, or is required to be air tested
2. All newly laid pipe or any valved section thereof shall be subjected to a pressure and leakage test
3. Contractor shall provide all labor, equipment, pumps, pipe, connections, gauges, measuring devices and all other necessary apparatus
4. Conduct tests in the presents of and to the satisfaction of the Engineer

F. Test Pressure and Duration of Test

1. Minimum test pressure shall be 3.5 psi
2. Maintain test pressure for a minimum of 2 hours
3. Mains shall be demonstrated to have no pressure drop over the test period

G. Air Tests

1. Conduct on all appropriate pipelines
2. Preparation for tests
  - a. Flush and clean pipeline as required

- b. Plug and brace all openings
  - c. Check all pipe plugs with soap solution to detect any air leakage
  - d. If leaks are found, release the air pressure, eliminate the leaks and start the procedure over again
3. Procedure of tests
- a. Add air until the internal pressure of the pipeline is raised to 4.0 psig
  - b. Reduce flow of air and maintain pressure for a sufficient time to allow the air temperature to come to equilibrium with the temperature of the pipe
  - c. After temperature has stabilized, drop pressure to 3.5 psig
  - d. Shut off air
  - e. Observe test pressure gauge over test period to establish acceptability of installation

#### H. Repair of Leaks

- 1. When test discloses leakage greater than the allowable leakage, Contractor shall locate and repair the defective joints until leakage is within the specified allowable
- 2. Contractor shall repair any specific leaks regardless of test results if, in the opinion of the Engineer, they are serious enough to endanger the future serviceability of the pipeline

END OF SECTION