**SECTION 02730**
**SEWAGE FORCE MAINS**

## PART 1 -- GENERAL

1.1 GENERAL

A. This Section includes materials and performance standards, and contractor responsibilities associated with the furnishing of all labor, materials, equipment and incidentals required to install and make ready for operation all sewage force mains as shown on the Drawings and as specified herein.

B. All materials, fittings and appurtenances intended for use in pressure pipe systems shall be designed and constructed for a minimum working pressure of 150 psi unless the specified application dictates higher working pressure requirement.

C. All construction material shall be first quality, not previously used. Damaged or faulty pipe and materials must be properly replaced.

D. Force main materials shall be PVC or ductile iron pipe. Standard pressure pipe fittings of size 4 inch ID (inside diameter) and larger shall be ductile iron.

E. Pipe gaskets shall be as supplied by the pipe manufacturer.

1.2 RELATED SECTIONS

A. Section 01100 – Design Criteria

B. Section 02640 – Utility Valves and Appurtenances

C. Section 02732 – Wastewater Pumping Station

D. Section 02760 – Performance Testing of Pressure Pipelines

1.3 SUBMITTALS

A. Submit shop drawings of all materials for sewage force mains, fittings, valves and services to be installed for approval, prior to ordering material.

B. Manufacturer and Fabricator Certification

## PART 2 -- PRODUCTS

2.1 FORCE MAINS

A. General

1. All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer, the batch number, the location of the plant, strength designation, and standards as applicable.

B. Polyvinyl Chloride (PVC)

1. PVC Sewer Main 4 inch to 12-inch diameter (4" – 12") shall be DR-18 manufactured to ductile iron pipe outside dimensions and in compliance with AWWA Standard C900 (Pressure Class 150). The pipe shall have an integral bell end and gasket seal with the joint in compliance with the requirements of ASTM D3139. The pipe color shall be white or brown with "Force Main" permanently printed on three sides for the entire length of the pipe.

2. PVC sewer main 14 inch to 20 inch diameter (14" – 20") shall be DR-21 manufactured to ductile iron pipe outside dimensions and in compliance with AWWA Standard C905. The pipe shall have an integral bell end and gasket seal with the joint in compliance with the requirements of ASTM D3139. The pipe color shall be white or brown with "Force Main" permanently printed on three sides for the entire length of the pipe.

3. Fittings: Ductile iron fittings shall be used on all PVC C900 & C905 mains. Fittings shall conform to AWWA/ANSI C110/A21.10 or AWWA/ANSI C or AWWA/ANSI C153/A21.53 for compact fittings with a minimum pressure rating of 350 psi.

C. Ductile Iron Pipe and Fittings

1. Ductile iron pipe shall be a minimum Pressure Class 350. SLCU reserves the right to require a different thickness class for unusual or non-standard laying conditions. Adequate protective measures against corrosion shall be determined by SLCU and the Engineer.

2. Ductile iron pipe shall conform to latest standards of ANSI/AWWA C150/A21.50 for the thickness design of ductile iron pipe and ANSI/AWWA C151/A21.51 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds. Flanged end pipe shall be Class 53, minimum.

3. Ductile iron pipe shall conform to the latest standards of ANSI / AWWA C150 / A21.50 for the thickness design of ductile iron pipe and ANSI / AWWA C151 / A21.51 for ductile iron pipe centrifugally cast in metal molds or sand-lined molds.

4. Joints for ductile iron pipe shall conform to the latest standard of ANSI / AWWA C111 / A21.11 for rubber gasket joints. All buried joints at fittings

must be restrained, mechanical joints. Restrained joint assemblies with mechanical joint pipe shall be by approved restraining devices.

5. Interior and exterior coatings for the ductile iron pipe shall conform to the latest standards of AWWA C210.

6. All required polyethylene encasement shall comply with AWWA/ANSI C105/A21.5, "Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and other liquids.

## 2.2 VALVES AND APPURTENANCES

A. Valves 3" and larger for sewer force mains shall be resilient seat, gate valves rated for 200 psi.

B. Valving of all systems shall be designed to facilitate the isolation of each section of pipeline as required.

C. Reference Section 02640 for additional requirements related to valves.

D. Automatic air release valves shall be installed at all high points of the main to prevent air accumulation within the main. Valve body shall be cast iron with stainless steel valve and float, suitable for the application, rated for 150 psi working pressure. Automatic air release valves shall be Crispin Model S20 (for 2" size) manufactured by Multiplex Manufacturing Co. or approved equal. Air release valves shall be installed in a manhole as shown on the SLCU Construction Standard Details.

## 2.3 WIRE LOCATOR FOR FORCE MAINS

A. On all pipe construction 10 gauge, THWN insulated, stranded copper wire shall be laid on top of the pipe.

B. Wire for sewage systems shall be brown in color.

## 2.4 CONNECTIONS FOR PRESSURE SYSTEMS

A. Tapping Tees and Valves: Tapping sleeves shall be split type epoxy coated iron body with flanged outlets for connecting to tapping valve. Finish to be fusion applied epoxy in accordance with AWWA C213.

B. Tapping valves shall be gate valves with resilient seat type with flanged by mechanical joint connections meeting the requirements of Section 02640 and shall be compatible with connecting sleeve and specially designed for wet tapping installations. Valve shall be Mueller H-667, or approved equal. Tapping valves shall

have a two-inch operating nut. Working pressure rating shall not be less than 200 psi. Gaskets between the flange faces of the tapping sleeve and tapping valve shall be 1/8" minimum thickness of neoprene rubber.

C. Size on Size Taps: Taps may be made on the same size main only when the main to be tapped is AWWA C900, C905 or DIP.

2.5 LOW PRESSURE FORCE MAIN

A. PVC pipe for low pressure mains must meet requirements as set forth in ASTM D2241, SDR-21, 200 psi, as a minimum for all low pressure mains. Pipe shall have push-on type joints with integral wall bell.

B. Fittings shall be manufactured in one piece of injection molded PVC meeting ASTM D-1784, class 200. Bell shall be gasketed joint conforming to ASTM D-3139 with gaskets conforming to ASTM F477. Push joint or mechanical joint ductile iron fittings meeting AWWA C153 shall be allowed as alternative when PVC sizes are not available.

C. Service line material shall be the same as specified above for the low pressure main. Service line can either be solvent weld or rubber ring joint. Schedule 40 PVC fittings shall be used on all service lines.

## PART 3 -- EXECUTION

3.1 EXISTING FACILITIES

A. Contractor is required to verify location of existing utility mains and valve configurations in all connection areas prior to beginning of construction in that area. Any discrepancies between the construction drawings and field conditions shall be brought to the attention of the Engineer of Record prior to construction in that area.

B. It will be the Contractor's responsibility to verify all existing utilities (telephone, gas, electric, cable, water, reclaimed water, and sewer services, etc.), whether shown in the construction drawings or not. The locations of all existing utilities indicated on the plans are shown for general informational purposes only. Any damage to existing utilities or services shall be repaired by the particular utility, or the Contractor, under direct authorization and supervision of the particular utility with all repair costs being incurred by the Contractor. Any discrepancies between the construction drawings and existing field conditions shall be brought to the attention of the Engineer of Record or his representative prior to construction in that area.

3.2 INSTALLATION

A. General Requirements:

1. Piping and fittings shall be installed in accordance with these Standards and in general with the manufacturer's recommendations for the applicable service.

2. Piping shall be installed along straight line and grade between fittings, or other defined points, unless other definite lines of alignment deflection or grade change have been established. Modification to approved alignment or grade during construction shall receive prior approval from the Engineer and all resulting design conflict shall be resolved by the Engineer prior to proceeding. The standard minimum cover for utility mains shall be as follows:

| | |
|---|---|
| Mains 8" diameter & less | 30" cover |
| Mains 14" diameter & more | 48" cover |
| Low Pressure Mains | 48" cover |

Protective concrete slabs are required in accordance with the construction details when the cover is less than the standard minimums shown above. Where waterways, canals, ditches, or other cuts are crossed, protective concrete slabs are also required across and to ten feet each side of the bottom. Additionally, approved utility crossing signs may be required along the pipe alignment at each side of the canal, etc. Signs shall be approved by SLCU and Agency having jurisdiction over said waterway.

3. All pipe shall be laid to line in a clean, dry trench on line and grade with all valves and appurtenances plumb. Backfill shall be clean suitable fill.

4. Materials shall be cleaned and maintained clean, with all coatings protected from damage. The interior of the pipe shall be free of dirt and debris, and when work is not in progress, all open ends shall be plugged, with an approved device.

5. Pipe and fittings, or other items shall be inspected prior to installation and any items showing a fracture or other defect shall be rejected. Additionally, any pipe or fitting which has received a severe blow that may have caused an incipient fracture indicated beyond that visible, may be salvaged by cutting off the damaged section 12 inches past, providing the remaining pipe is sound. Discoloration of PVC due to exposure to the sun may result in pipe rejection.

6. Underground piping shall not be driven to grade by striking it. When the pipe has been properly bedded, enough compacted backfill shall be placed to hold the utility in correct alignment. If necessary, precaution shall be taken to prevent flotation.

7. Jointing shall be by the manufacturer's approved method and shall not require undue force to accomplish full satisfactory seating and assembly.

Connections at structures shall be cut accurately and worked into place without forcing and shall align with the connecting point. Flanged joints shall be made up tight, but with care taken to prevent undue strain upon equipment or other items. Suitable flange filler rings shall be installed where required to provide suitable joints. The installation shall be permanently water tight, with no visible leakage at joints, connections with structures or other locations, under operational or testing conditions. Material that in jointing does not remain completely seated and/or watertight shall be rejected.

8. Underground pressure piping systems shall be securely anchored by acceptable means at all tees, plugs, caps, bends and valves, and at all other locations where unbalanced forces exist or as directed by SLCU or Engineer of Record. Restrained joints shall be used in accordance with manufacturer's recommendations. Reference the SLCU Construction Standard Details for requirements related to pipe restraints.

9. Acceptable pipe restraint devices are Uni-Flange, Mega-Lug, or approved equal restraining systems. Shop drawing shall specify the particular system to be utilized and no substitutions will be allowed after approval without resubmittal of shop drawings and written approval by SLCU. Every pipe joint that is required to be restrained shall be inspected by SLCU or Engineer of Record prior to the Contractor backfilling the restrained joint.

10. Exposed systems shall be supported as necessary to hold the piping and appurtenances in a firm, substantial manner to the required lines and grades indicated, with no undue piping stresses transmitted to equipment or other items. Pipe aboveground outside of buildings shall be supported on concrete supports or premanufactured adjustable pipe supports.

11. Subaqueous pipe laying may be permitted where conditions make it impractical to lay pipe "in the dry", provided the Contractor submits his plans for laying pipe under water to SLCU and Engineer and obtains advance approval thereof. All subaqueous crossings shall be made in accordance with all approved permits.

12. Special Exterior Protection for Corrosion: Extra protection shall be provided for underground cast or ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement in accordance with the requirements of AWWA C105, through the area of concern. Soil-test evaluation to determine the necessity for extra protection in suspect areas shall be as set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, cast or ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side, and when installed parallel to and within ten feet of, protection shall also be provided. Steel pipe shall <u>not</u> be installed in severe corrosion areas.

13. In case of conflict between various installation requirements the more stringent requirement shall apply.

14. All pipeline laying, testing, etc. shall be performed in the presence of SLCU and/or engineer of Record or their designated representative.

15. Pipeline joint deflections shall be as stated within Uni-Bell Handbook of PVC Pipe or the manufacturer's maximum allowable deflection, whichever is less.

B. Ductile Iron Pipe: Installation shall be performed in accordance with the applicable provisions of AWWA Standard C600 and the manufacturer's recommendations.

C. Polyvinyl Chloride Pipe (C900 & C905): Installation shall be performed in accordance with the applicable provisions of AWWA C-900, ASTM D-2774, AWWA Manual M23 and the manufacturers recommendations. Lubrication used for pipe and fitting joints shall be nontoxic.

D. Polyvinyl Chloride Pipe (SDR-21): Installation shall be performed in accordance with the applicable provisions of ASTM D-2774, Uni-Bell B-3 for PVC pressure sewer pipe and with the manufacturer's recommendations. Wherever there are conflicts in installation methods, the more stringent installation criteria shall apply.

E. Parallel/Horizontal Separation

1. Reference requirements in Section 01100, Design Criteria for horizontal and vertical separation requirements.

F. Valves

1. All valves shall be placed according to plan unless relocation is mutually agreed to. Record or as built drawings shall reflect the actual location and size of all mains, hydrants, services and valves.

F. Connecting Tapping Tees and Valves

1. A SLCU representative shall approve each location proposed for connection of the new system to the existing system before the tapping sleeve is installed. Tapping sleeves shall not be installed within 3 feet of any joint or fitting.

After the tapping tee is attached to the main, the gate valve shall be closed and tapping tee and gate valve assembly shall be pressured tested at 150 psi for a minimum of 1 hour with water. A SLCU representative shall witness the pressure test. No visible leaks or loss of pressure shall be evident. After

pressure testing, the main may be tapped. Only shell type cutters shall be used. The coupon from the hole that is cut shall be delivered to SLCU.

G. Locator for Sewer Force Main Pipe

1. THWN insulated, stranded copper wire shall be laid and secured on top of pipe. Wire shall be continuous from valve box to valve box, wrapped two times around each joint of pipe and extended inside each valve box to enable location devices to be attached without digging up the valve box (see Standard Construction Details).
Wire for sewer force mains shall be brown in color.

All wire connections shall be made with Dri-Splice wire connectors, Imperial Snip-Snap fittings filled with waterproof silicone sealant or approved equal. All splices shall be inspected by SLCU before burial.

H. Cleaning and Flushing

1. After its installation, the complete sewer force main system (including all mains, services, air release valves and all other appurtenances) shall be thoroughly flushed to remove all foreign matter. SLCU shall be notified at least 24 hours in advance of any flushing activities. Reference Section 02670 for additional requirements related to cleaning and flushing.

I. Pressure Testing

1. All mains shall be tested for leakage. Water shall be supplied to the main and pumped to the required 150 psi pressure. The main tested shall be isolated from existing connecting force mains

2. SLCU shall be notified at least 48 hours in advance of any testing procedures. After flushing is completed, line pressure shall be applied to the complete sewer force main system to determine if any major defects are present. The complete system shall then be tested at a pressure of 150 psi for a period of not less than two hours. SLCU may, at its discretion, increase the period to four hours. No visible movement of the systems shall occur and leakage shall not exceed:

$$L = \frac{N * D * \sqrt{P}}{7400}$$

Where L = Leakage in gallons
N = Number of joints in test section
P = Test pressure in psi
D = Diameter of pipe in inches

(For P = 150 p.s.i., L= ND (.001655))

3. Reference Section 02670 for additional requirements related to pressure testing.

*** * END OF SECTION * ***