

## SECTION 02724

### VITRIFIED CLAY PIPE SEWERS

#### PART 1 - GENERAL

##### 1.1 SCOPE

The work included in this section includes furnishing all labor, equipment, and materials required to install, test, and inspect vitrified clay pipe sewers, including all risers, plugs, fittings and bedding, as shown on the Drawings and/or specified herein.

##### 1.2 QUALITY ASSURANCE

- A. The Contractor shall submit to the Engineer written evidence that the pipe furnished under this Specification is in conformance with the requirements specified herein. Certified copies of independent laboratory test results or mill test result from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.
- B. Each pipe shall be clearly marked as required by the governing ASTM standard specifications to show its class date of manufacture, and the name or trademark of the manufacturer.
- C. Any pipe or specials which have been broken, cracked or otherwise damaged before or after delivery or which have failed to meet the required tests, shall be removed from the site of the work and shall not be used therein.

##### 1.3 GUARANTEE

The Contractor shall provide a guarantee against defective materials and workmanship in accordance with the requirements of the section entitled "Warranties and Bonds" of these Specifications.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Pipe and special fittings shall be furnished in sizes, types and classes at the locations shown on the Drawings, and/or specified herein.
- B. All pipe and specials shall be new materials which have not been previously used.

### 2.2 BEDDING

- A. Bedding for concrete and clay pipe shall be provided in three (3) classes, Class A, Class B and Class C, as shown on the Drawings to fit the depth of trench, type and size of pipe, width of trench, and bearing value of subgrade.
- B. Class A Bedding shall consist of Class B concrete cradles constructed as shown on the Drawings. Wherever the Contractor places concrete for cradles outside the dimensions shown on the Drawings, the cost of such concrete will be at the expense of the Contractor.
- C. Where concrete cradle is used, the pipe shall be laid on concrete saddles so constructed as to provide both vertical and lateral support for the pipe while the cradle is being placed. Pipe supports of wood block, loose brick, etc., will not be permitted. The concrete cradle shall be poured after the joints have been made, care being taken to prevent movement of the pipe.
- D. Class B Bedding shall consist of ½-inch or smaller crushed rock or gravel, sand or other approved granular materials as shown on the Drawings. Placement of this material shall be done carefully. Material shall be thoroughly compacted by tamping.
- E. Class C Bedding shall be as shown on the drawings and shall consist of proper grading of the trench and placement of the backfill in adequately tamped condition to a level at least 12 inches above the top of the pipe or to higher levels as, if, and where so provided for on the plans and/or in the specifications.
- F. The determination of the bedding class shall be from actual width of trench. If Contractor increases width of trench for his convenience or due to collapse of trench walls so that a higher class of bedding is required, the increased cost of same shall be borne by the Contractor. If the bearing value of the subgrade is determined by the Engineer to be inadequate for a particular class of bedding, the Contractor shall substitute a higher class of bedding as directed by the Engineer.

- G. Bedding shall be in accordance with the schedule and dimensions shown on the Drawings and shall be placed where shown on the Drawings.

## 2.3 CLAY PIPE

- A. All clay pipe and fittings shall conform to the latest requirements of ASTM C 700 for Extra Strength Clay Pipe.
- B. Vitrified clay pipe shall be joined in one of the two following ways:
  - 1. By use of a compression sleeve manufactured to conform to the latest requirements of ASTM C 425 with lubricant as recommended by the manufacturer. The joint material shall be bonded to the pipe at the factory. The joint shall be completed by using a PVC collar designed to apply the proper pressure to the compression sleeve. The collar shall be designed with an internal positioning ring to center the joint in the collar and to prevent solid contact between the ends of the pipes being joined.
  - 2. By use of a flexible compression joint conforming in all respects to ASTM C 425. Joint shall have polyester resin castings in the bell and on the spigot, which shall be bonded to the pipe at the factory. A rubber "O" Ring gasket shall be provided to fit in the groove on the spigot end which will form a tight and flexible compression joint when assembled. Joint lubricant shall be as recommended by the pipe manufacturer.

## PART 3 - EXECUTION

### 3.1 PIPE LAYING

- A. Before sewer pipe is placed in position in the trench, the bottom and sides of the trench shall be carefully prepared and bracing and sheeting installed where required. A mason's line, supported at intervals not exceeding 50 feet, shall be stretched tightly above round level at a grade parallel to and directly above the axis line of the pipe. Each pipe shall be accurately placed to the exact line and grade called for on the Drawings by measuring down from this line to the invert of the pipe in place. The Contractor shall furnish all labor and materials necessary for erecting batter boards and establishing lines and grades therefor.
- B. The Contractor may use the laser beam method of setting a line and grade for the sewer by using the laser beam coaxially through the center of the sewer being laid. The laser beam projector is to be rigidly mounted to its support platforms, with a two-point suspension, or equivalent, assuring that all ground and equipment vibrations are kept to an absolute minimum. All equipment including

equipment necessary to control atmospheric conditions in the pipe to keep line and grade to acceptable standards of accuracy shall be furnished by the Contractor. The laser beam system must be operated by competent experienced men who have been properly trained to operate the equipment used.

- C. The Contractor shall stake check pegs at all manholes throughout the job. Check pegs midway between manholes and any other check points deemed necessary to assure accuracy of the equipment shall be provided by the Contractor.
- D. Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells uphill. No pipe shall be laid except in the presence of an inspector representing the Engineer. Trench bottoms found to be unsuitable for foundations after pipe laying operations have started shall be corrected and brought to exact line and grade with approved compacted materials.
- E. Bell holes shall be of sufficient size to allow ample room for making the pipe joints properly. Bell holes shall not be cut out more than 10 joints ahead of pipe laying. The bottom of the trench between bell holes shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length as shown on the Drawings. Each joint shall be laid so that it will form a close concentric joint with adjoining pipe in order to avoid sudden offsets or inequalities in the flow line.
- F. Water shall not be allowed to run or stand in the trench while pipe laying is in progress or before the joints are completely set or before the trench has been backfilled. The Contractor at no time shall open up more trench than his available pumping facilities are able to dewater. Where sewer pipelines are located in or across stream beds or drainage ditches, the Contractor shall divert the stream flow and dewater each section as the work progresses.
- G. No joints shall be made where pipe or joint materials have been soiled by earth in handling until such soiled surfaces are thoroughly cleaned by wire brushing and wiping until all traces of the earth are removed.
- H. As the work progresses, the interior of all pipe shall be kept thoroughly clean. After each line of pipe has been laid, it shall be carefully inspected and all earth, trash, rags and other foreign matter removed from the interior. A filled bag or other approved type of follower shall be pulled through the line immediately after each joint is made in order to remove any debris which may be left on the inside of the pipe.

- I. Backfilling of trenches shall be started immediately after the pipe in place has been inspected and approved by the Engineer and backfill shall be deposited and compacted as provided under the section entitled "Earthwork" of these Specifications.

### 3.2 JOINT CONSTRUCTION

#### A. Compression Type Joints

1. Compression type coupling on vitrified clay pipe shall be jointed in accordance with the pipe manufacturer's recommendations using all the necessary materials, lubricants, adhesives and equipment as recommended by the manufacturer.
2. Defective joints discovered after laying shall be removed and replaced with new sections of pipe having undamaged joints. Defective pipes shall be removed and proper replacement made.
3. All openings shall be closed with an approved type vitrified clay or concrete plug held securely in place. Dead ends of sewer lines shall be similarly stoppered.

### 3.3 INSTALLATION OF TEES, RISERS AND PLUGGED STUBS

- A. Tee branches shall be installed in the sewer lines at all places shown on the Drawings, specified herein or otherwise directed by the Engineer. Tee branches on pipe less than 12 inches in diameter shall be cast or extruded and manufactured monolithic with the barrel.
- B. Riser connections, of the size and type shown on the Drawings shall be installed at the locations shown on the Drawings or directed by the Engineer. A plastic film marking tape 5-feet long shall be placed 12 inches over the top of each riser during backfilling to mark the location of the riser. The marking tape shall be heavy gauge polyethylene film (.004 inch thick). Tape shall be standard red color imprinted with the words "Warning - Buried Sewer Line Below". Tape shall be Allen Marking Tape No. AMT-1212 as manufactured by the Allen System, Inc., Glen Ellyn, Illinois, or equal. A second marking tape containing a metallic core which can be located with a metal detector shall be laid on top of the first marking tape. This tape shall be 5 feet long and 3 inches wide. Tape shall be Allen Detectotape Catalogue No. ADT-1003 for buried sewer line manufactured by the Allen System, Inc., or equal.

- C. Plugged pipe stubs for future connections to manholes and sewerage structures shall be installed where shown on the Drawings or directed by the Engineer. The pipe stubs shall be installed with the bell encased in the wall of the manhole and the bell opening flush with the outside wall of the manhole or structure.
- D. Plugged stubs and such branches of pipelines that are not to be used immediately shall be closed with compatible stoppers held securely in place.
- E. Where specifically directed by the Engineer or shown on the Drawings, connections to reinforced concrete pipe over 18 inches in diameter shall be made in accordance with details shown on the Drawings.

### 3.4 CONNECTIONS

- A. If the work consists of the construction of sewer that is to replace an existing sewer, all of the existing service lines shall be kept in operation and connected to the new line.
- B. Connections shall be made to all existing sewer lines in the vicinity of the work by removing a section of the sewer from the existing line and inserting in the space a tee branch of proper size, or by the construction of a manhole over the existing line.
- C. Connections to existing manholes or inlets where no plugged stubs exist shall be made by cutting a hole in the wall of the existing structure, inserting a length of sewer pipe into the hole, filling around same with concrete or mortar and troweling the inside and outside surfaces of the joint to a neat finish. The bottom of the manhole shall be shaped to fit the invert of the sewer pipe as specified under the section entitled "Manholes" of these Specifications.
- D. Connections to building services shall be made in a neat and workmanlike manner. Cleanout plugs shall be installed, wherever feasible, by making the connection with a standard wye or tee.

### 3.5 EXISTING UTILITIES

- A. All existing sewers, water lines, gas lines, underground conduits, telephone lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work shall be carefully protected by the Contractor from damage at all times. Where it is necessary for the proper accomplishment of the work to repair, remove and/or replace any such utility, the work shall be done under the provisions set forth in the "General Conditions." No separate payment shall be made for removing and replacing and/or repairing damaged existing sewers; water, gas, electric, telephone lines or conduits; or other utilities,

culverts, drains, or conduits of similar existing services or structures. Similar repair and replacement of sidewalks, curbs, gutters, and pavements are provided elsewhere in these Specifications.

- B. Sewers shall be laid at least 10 feet, horizontally, from any existing or proposed water main. If conditions prevent the 10-foot separation, the sewer may be constructed closer to a water main if it is laid in a separate trench and if the elevation of the top of the water main is at least 18 inches above the invert of the sewer.
- C. When sewers cross under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If necessary, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint cast iron or ductile iron pipe for a distance of 10 feet on each side of the sewer. One full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible.
- D. When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both water main and sewer shall be constructed of mechanical-joint cast iron pipe and shall be pressure tested to assure water tightness.
- E. When sewer lines cross under culverts where the sewer and the culvert are less than 18 inches apart, the sewer line shall be encased in concrete or shall be constructed of ductile iron if shown on the drawings.

### 3.6 INSPECTION AND TESTING

- A. After completion of any section of sewerage, the grades, joints, and alignment shall be true to line and grade. Joint surfaces shall be smooth. There shall be no visual leakage and the sewer shall be completely free from any cracks and from protruding joint materials, deposits of sand, mortar or other materials on the inside.
- B. Infiltration shall not exceed 50 gallons per 24 hours per inch of diameter per mile of sewer. Contractor shall furnish all supplies, materials, labor, services, etc., needed to make infiltration or exfiltration tests including water. No separate payment will be made for equipment, supplies, material, water, or services.
- C. Any leakage, including active seepage, shall be corrected by removal and replacement of pipe or joint where such leakage exists until the pipelines meet the requirements of the allowable leakage specifications.
- D. Infiltration tests shall be made when groundwater level is 18 inches or more above the top of the outside of the pipe.

- E. When normal groundwater does not stand at a level outside the pipe to enable infiltration tests to be made to the satisfaction of the Engineer, the Contractor may make exfiltration tests by filling the pipe or sections thereof with water to a head of not less than 2 feet above the top of the outside of the pipe and observing the amount of water required to maintain this level.
- F. Low pressure air testing may be used in lieu of infiltration testing at the Contractor's request and upon approval by the Engineer. When approved by the Engineer, Low Pressure Air Test shall be made in accordance with the procedures and standards listed below.
1. Clean pipe to be tested by propelling snug-fitting inflated rubber ball through pipe with water.
  2. Plug all pipe outlets with suitable test plugs. Brace each plug securely to prevent blowouts. As a safety precaution, pressurizing equipment shall include a regulator set at slightly above test pressure to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manhole during testing.
  3. If the pipe to be tested is submerged in groundwater, insert a pipe probe by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to groundwater submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.
  4. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
  5. After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
  6. When pressure decreases to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding times for runs of single pipe diameter are indicated in the table in seconds. Times for mixed pipe sizes of varying should be calculated as described in ASTM C 828 using formula  $t = K \times d^2 L/q$  ( $q = 0.0020$ ).



Nominal Pipe Size, In.	T (time) min/100 ft.	Nominal Pipe Size, In.	T (time) min/100 ft.
3	0.2	21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
18	2.4	42	7.3

- G. Final Inspection Preceding Acceptance: Final inspection will include a visual inspection of each section of sewer by looking from manhole to manhole with the aid of reflected sunlight or an electric torch. Such light used for inspection shall be plainly visible from manhole to manhole. Reflected light from manhole to manhole will not be considered as plainly visible light and shall be reason for rejection of the section of sewer as not being laid true to line and grade. The pipe shall be true to both line and grade; shall show no leaks, shall be free from cracks, and protruding joint materials and contain no deposits of sand, dirt, or other materials which will reduce the full cross sectional area. Ground water infiltration shall not exceed the rates hereinbefore stipulated and shall be distributed uniformly throughout the collecting system and not occur through a few joints. All joints shall be tight. All finished work shall be neat in appearance and of first class workmanship.

### 3.7 CLEANUP

After completing each section of the sewer line, the contractor shall remove all debris and construction materials and equipment from the site of the work, grade and smooth over the surface on both sides of the line and leave the entire right-of-way in a clean, neat and serviceable condition.

END OF SECTION 02724.