

SECTION 02736

SANITARY SEWER

PART 1 GENERAL

1.01 RELATED WORK

Section 02225 - Earthwork for Utilities

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. American Water Works Association (AWWA).
- C. American National Standards Institute (ANSI).

1.03 QUALITY ASSURANCE

- A. Each pipe shall be clearly marked as required by governing ASTM standard specifications to show its class, date of manufacture, and name or trademark of manufacturer.
- B. Any pipe or specials that have been broken, cracked, or otherwise damaged before or after delivery, or which have failed to meet required tests, shall be removed from site of work and shall not be used.

1.04 DELIVERY, STORAGE AND HANDLING

- A. DEVELOPER/CONTRACTOR shall be responsible for safe unloading, storage and care of material furnished by or to him until it has been incorporated into the WORK.
- B. Unload pipe, fittings, or valves by lifting with hoists or skidding to avoid damage.
 - 1. Pipe shall not be unloaded by rolling or dropping off trucks.
 - 2. Pipe handled on skidways shall not be skidded or rolled against pipe already on ground. Unload material at site of work, near place where it will be placed in trench.
- C. Unload material at site of work, near place where it will be placed in trench.
 - 1. Materials shall be placed for least interference with traffic.
 - 2. Provide signs, lights, and barricades as necessary to protect public.

- D. Handle material carefully to prevent breakage and to avoid damage to coatings and linings.
 - 1. Keep interior of pipe, fittings and valves, free of dirt or foreign matter at all times.
 - 2. Do not place materials in drainage ways or ditches.

PART 2 PRODUCTS

2.01 GENERAL

- A. Pipe and fittings shall be new materials which have not been previously used.
- B. Minimum depth for sanitary sewer shall be three (3) feet except under pavement; then, the minimum depth shall be seven (7) feet.
- C. All sewer lines shall be DIP or PVC.
- D. Any sanitary sewer with a depth of fifteen (15) feet or greater shall be DIP.
- E. Any sanitary sewer less than seven (7) feet under pavement shall be DIP.

2.02 BEDDING AND BACKFILL

- A. Bedding material shall be as specified in Section 02225 (Earthwork for Utilities).
- B. Backfill material shall be as specified in Section 02225 (Earthwork for Utilities).

2.03 DUCTILE IRON PIPE (DIP)

- A. Ductile iron pipe supplied may be push-on, mechanical, or flanged joint.
- B. Ductile iron pipe shall:
 - 1. Conform to AWWA C150 and AWWA C151.
 - 2. Be thickness pressure class 350.
 - 3. Be cement lined in accordance with AWWA C104.
 - 4. Have rubber jointed gaskets conforming to AWWA C111.
 - 5. Be painted green.
- C. The weight, casting period, and class or nominal thickness shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be clear and legible. All cast marks shall be on, or near, the bell.

2.04 POLYVINYL CHLORIDE PIPE (PVC)

- A. Pipe shall meet all requirements of ASTM D-3034, SDR-35, unless otherwise specified. Pipe shall be unplasticized polyvinyl chloride with integral wall bell and spigot joints with a rubber ring gasket.
- B. Fittings shall meet all requirements of ASTM D-3034, SDR-35, unless otherwise specified. PVC material shall have a cell classification of 12454-B or C as defined in ASTM D-1784. Fittings in sizes through 8" shall be molded in one piece. Fittings 10" and larger shall be molded or fabricated. Gaskets shall have a minimum cross-sectional area of 0.20 sq. in. and conform to ASTM F-477.
- C. Provisions must be made for contraction and expansion at each joint with an elastomeric gasketed joint.
- D. Joints shall utilize rubber gaskets conforming to ASTM F477.
- E. Standard lengths shall be a maximum of 20 feet.

2.05 CLEANOUTS

- A. Pipe cleanouts shall be the same size as the pipe. A cleanout installation shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. A countersunk PVC screw plug shall be caulked in female adapter.
- B. An 18" diameter or square by 4" thick concrete cleanout collar shall be provided for each cleanout.

2.06 FLEXIBLE COUPLINGS

- A. Flexible Coupling shall be made of polyvinyl chloride with stainless steel sheer ring, manufactured by FERNCO, Davison, Michigan or approved equivalent.
- B. Sizes of flexible couplings shall be selected according to the types of pipe material being used.

2.07 SPARE PARTS

- A. To be determined at end of construction by Town.

PART 3 EXECUTION

3.01 PIPE LAYING

- A. Manholes shall be installed at a maximum distance of 400 feet.
- B. PVC sewer laterals; shall have Class 'B' bedding, minimum. DIP shall have Class 'C' bedding, minimum.

- C. Contractor shall verify that no sewer is being installed within 10 lateral feet or 18 vertical inches of an existing waterline. Where crossings do occur, the sewer pipe is to be located so that both joints are as far from the water main as possible, and sliplined or encased in concrete. See the latest edition of the Recommended Standards for Wastewater Facilities, Great Lakes-Upper Mississippi River Board of State Public Health and Engineering Managers, Section 38.3 and Braselton Standard Detail S-33.
- D. Excavation and pipe bedding shall be performed in accordance with Section 02225 (Earthwork for Utilities).
- E. Each piece of pipe and each fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in trench. Pipe laying shall proceed upgrade, starting at lower end of grade and with the bells uphill.
- F. Bell holes shall be sufficient size to allow ample room for making pipe joints properly. Bell holes shall not be cut out more than ten joints ahead of pipe laying. 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 flow line.
- G. Water shall not be allowed to run or stand in trench while pipe laying is in progress, before the joints are completely set, or before trench has been backfilled.
- H. 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 earth are removed.
- I. As work progresses, interior of all pipe shall be kept thoroughly clean. After each line of pipe has been laid, all earth, trash, rags and other foreign matter shall be removed from interior.
- J. Backfilling of trenches shall start immediately after the pipe has been installed. Backfill shall be deposited and compacted as provided under Section 02225 (Earthwork for Utilities).
- K. Full length of each section of pipe shall rest solidly upon the bedding. Any pipe that has its alignment, grade or joints disturbed after laying shall be taken up and relaid.
- L. Lay pipe with bell ends facing in direction of laying against direction of flow.
 - 1. Where pipe is laid on grade of 10 percent or greater, laying shall start at bottom and shall proceed upward with bell ends of pipe upgrade.
- M. Piping shall have a minimum slope as per the Ten States Standards.

<u>Nominal Sewer Size</u>	<u>Minimum Slope in ft/100ft (m/100m)</u>
8 inch (200mm)-----	0.40
10 inch (250mm)-----	0.28
12 inch (300mm)-----	0.22
14 inch (350mm)-----	0.17
15 inch (375mm)-----	0.15
16 inch (400mm)-----	0.14
18 inch (450mm)-----	0.12
21 inch (525mm)-----	0.10
24 inch (600mm)-----	0.08
27 inch (675mm)-----	0.067
30 inch (750mm)-----	0.058
33 inch (825mm)-----	0.052
36 inch (900mm)-----	0.046
39 inch (975mm)-----	0.041
42 inch (1050 mm)-----	0.037

- N. Maximum slopes and velocities shall be in accordance with the Ten States Standards as follows:
1. Where design velocities exceed 15 feet per second, special provisions incorporated to protect against displacement by erosion and impact.
 2. Sewers on 20 percent slopes or greater shall be anchored securely with concrete, or equal, anchors spaced as follows:
 - a. Not over 36 feet center to center on grades 20 percent and up to 35 percent
 - b. Not over 24 feet center to center on grades 35 percent and up to 50 percent
 - c. Not over 16 feet center to center on grades 50 percent and higher.

3.02 DETECTION TAPE

- A. Detector marking tape shall be non-metallic and shall be installed minimum 2 feet above the pipe. Tape shall be high visibility green and minimum 2 inches wide. Lettering shall read "Caution: Buried Sewer Line".
- B. Detection wire shall be green size #12 AWG, installed the entire length of the sewer main and the sewer laterals. For each joint of pipe, wire shall be looped around pipe a minimum of three (3) times and properly connect to fittings and valves so line can be relocated with a pipe finder after burial.

3.03 REPAIR CONNECTIONS

- A. When repair connections are to be made, the Town has the ultimate discretion to approve or disapprove of the proposed repair method by the CONTRACTOR. Existing pipe

wastewater flow is to be stopped. If necessary, temporary measures are to be taken to ensure continuous sewer service.

- B. Saw cut the existing pipe five feet (5') minimum each side of the break.
- C. Prepare pipe bedding in accordance with the Standard Bedding Details.
- D. Replace the pipe with a section of pipe that is the same diameter and length as that removed.
- E. Insert the flexible couplings and tighten in accordance with the manufacturers specifications.
- F. Insert the stainless steel sheer ring in accordance with the manufacturer's specifications.
- G. Prior to backfilling the open trench, allow flow to return to the pipe and check for leaks.
- H. Backfill the trench in accordance with Section 02225 - Earthwork for Utilities.
- I. Videotape and perform pressure tests in accordance with this Section, Part 3.

3.04 SERVICE CONNECTIONS

- A. Service connections to the main sewer shall be provided as per the Standard Details. Each service line is to have a cleanout at the property line and cleanouts located along the service line between the property line and the building. The spacing of the cleanouts shall not exceed 80 feet. Cleanouts will also be provided at all 90 degree and 45 degree horizontal bends. Services lines will be run at a minimum grade of 1%. If there is more than one discharge point from the building to be served, (i.e. bathroom discharge separate from laundry discharge) then they shall be combined to enter the trunk sewer as one.
- B. If the existing structure does not have toilet facilities, then the service piping shall be run to within two feet (2') of the lowest point on the perimeter of the structure and marked as described above.
- D. Saddle taps are not to be used on new sewer mains. Tee-wyes of the appropriate size are to be used.
- E. Where connection to an existing sewer is necessary, it shall be performed with a saddle tap core. "Knock-outs" will NOT be allowed. All cores are to be performed in the presence of a representative of the TOWN.
- F. Service laterals for residential commercial or industrial applications shall be SDR 35 PVC (ASTM 3034).

3.05 JOINT CONSTRUCTION

All joints for the various types of pipes shall be installed in accordance with pertinent AWWA, ASTM, and manufacturer's specifications. Any defective work will be removed and replaced if it cannot be corrected in accordance with the above mentioned specifications.

3.06 INSPECTION

- A. The pipe inspector shall be notified no later than 48 hours (Monday through Friday) before installed pipe is scheduled to be buried, tested, or inspected.
- B. Prior to scheduling any testing of the sewer infrastructure, all final grading and stabilization including cuts and fills must be complete in the vicinity of the sewer piping. No official testing of manholes and piping (air test, mandrel, video, vacuum test, etc.) shall begin until final grade, sub-base, and curb has been completely installed on site. Once final grade has been established, the DEVELOPER may request and schedule inspection and testing with the TOWN. Testing shall not commence until the TOWN is satisfied that the above criteria and the intentions of said criteria have been met.
- C. After completion of any section of pipe, the grades, joints and alignment shall be true to line and grade.
 - 1. Joint surfaces shall be smooth.
 - 2. There shall be no visible leakage and sewer shall be completely free from any cracks, protruding joint materials, deposits of sand, mortar or other materials on inside.
- D. Low Pressure Air Leakage Testing

Immediately following cleaning, the installed sewer shall be tested using low pressure air. This testing shall be conducted in accordance with ASTM Section F-1417-92, "Time-Pressure Drop Method". General procedures are as follows:

- 1. Isolate the section of sewer line to be tested by inflatable stoppers or other suitable test plugs.
- 2. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. All plugs and caps shall be securely braced to prevent blow-out. One of the plugs or caps should have an inlet tap, or other provision for connecting a hose to a portable air control source.
- 3. Connect the air hose to the inlet tap and portable air control source. The air equipment shall consist of necessary valves and pressure gages to control an oil-free air source and the rate at which air flows into the test section to enable monitoring of the air pressure within the test section.

4. Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig.
5. After the pressure of 4.0 psig is obtained, regulate the air supply so that the pressure is maintained between 3.5 to 4.0 psig for at least 2 minutes depending on air/ground temperature conditions. The air temperature should stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until equilibrium is obtained; however, a minimum of 3.5 psig is required.
6. All test pressures are measured as gage pressure, which is any pressure greater than atmospheric pressure. Since water produces a pressure of 0.43 psi for every foot of depth, air test pressures must be increased to offset the depth of ground water over the sewer line. If the ground water level is 2-feet or more above the top of the pipe at the upstream end, or if the air pressure required for the test is greater than 9-psi gage, the air test method should not be used. Before the air test method is used, the ground water level should be lowered by pumping or dewatering.
7. *Time-Pressure Drop Method*—Air is slowly introduced into the section of pipe to be tested, until the air pressure is raised to approximately 4.0 psi and the test pipe section is stabilized. Disconnect the air supply and decrease the pressure to 3.5 psi before starting the test. Determine the time required for the pressure to drop from 3.5 psi to 2.5 psi, and compare this interval to the required time to decide if the rate of air loss is within the allowable. Minimum holding times required by pipe diameter are shown in Table 1.

Table 1

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	230:46

8. If pipe installation fails to meet these requirements, CONTRACTOR shall determine source or sources of leakage, and shall repair or replace all defective materials or workmanship.

9. Final acceptance of each section or run of sewer tested will not be issued until leakage has been reduced to rates not exceeding maximum specified herein.

E. Mandrel Testing

A mandrel test of the sewer shall be made at least 30 days after backfilling as follows:

1. Developer is to utilize an approved mandrel kit to test all reaches of the sewer.
2. Mandrel shall be pulled through all gravity sewer pipe while TOWN's representative is present.
3. Mandrel shall be sized to allow 5% maximum deflection in pipe dimension..

F. Video Record

1. DEVELOPER/CONTRACTOR is to provide the TOWN with a color VHS or DVD system video of the inside of every reach of sanitary sewer installed.
2. Video shall record the following information:
 - a. Manhole number to manhole number
 - b. Date of recording
 - c. Distance record from start of run
 - d. Distance and location description of every service line connection installed.
3. Video shall be labeled with date of recording and location.
4. The manhole numbering system shall be the same as shown on the approved Development Drawings.

G. Miscellaneous Items

1. Safety Precautions: Low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, a line is over pressurized or plugs are installed improperly. It is extremely important that various plugs be installed so as to prevent sudden expulsion of a poorly installed or partially inflated plug (i.e., a force of 250 lbs. (112N) is exerted on an 8-inch (200 mm) plug by an internal pressure of 5 psi (34 kPa)). Observe the following precautions:
 - a) No one shall be allowed in manholes during testing because of hazards.
 - b) Install all plugs securely.
 - c) When lines are to be tested, it may be necessary that plugs be braced as an added safety factor.
2. Special Equipment
 - a) Air compressor with capacity of 85 cubic feet to 125 cubic feet.

- b) Pressure bags (plugs) for each size of pipe installed.
- c) Bracing material for plugs may be required during testing as an added safety factor.

3.07 FINAL ACCEPTANCE

- A. Final inspection will include a visual observation of each section of sewer by looking from manhole to manhole with aid of reflected sunlight or an electric torch in the presence of the TOWN's REPRESENTATIVE.
- B. 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 section of sewer as not being laid true to line and grade.
- C. Pipe shall be true to line and grade; shall show no leaks; shall be free from cracks and dirt or other materials which will reduce full cross sectional area.
- D. Joints shall be tight.
- E. Finished acceptance of each section or run of sewer tested will not be issued until leakage has been reduced to rates not exceeding maximum specified herein as permissible.

END OF SECTION