

SECTION 2400

SANITARY SEWER LINES

1.00 GENERAL

1.01 Scope. Work under this section shall include furnishing all materials, labor and tools necessary to perform all installation, cleaning and testing of all sanitary sewer lines and appurtenances as specified herein and shown on the Drawings.

1.02 Related Work Specified Elsewhere.

Section 2130 - Trenching, Backfilling and Compaction
Section 2140 - Embedment and Base Course Aggregate
Section 2500 - Hot Bituminous Pavement

1.03 Submittals. Product data including catalog sheets and descriptive literature shall be submitted for all materials and equipment specified. Submittals shall state manufacturer's compliance with all published standards referenced herein.

1.04 Protection of Work. All pipe, fittings and equipment shall be carefully handled, stored and protected in such a manner as to prevent damage to materials. At no time shall such materials be dropped or dumped into trench.

Precaution shall be taken to prevent foreign matter from entering the pipe and fittings prior to and during installation. Place no debris, tools, clothing or other materials in the pipe during installation.

At such time as pipe installation is suspended, either temporarily or over night, the open end of the pipe shall be sealed with a water-tight plug to prevent entrance of trench water, debris or foreign matter.

Under no circumstances shall trench water be allowed to enter the pipeline. When water is present in the trench, the seal shall remain in place until such time the trench is pumped dry. Whenever trench water becomes evident, adequate measures shall be taken to prevent pipe flotation.

If, in the opinion of the Engineer, the Contractor is incapable of keeping the pipe free of foreign matter during installation, the Engineer shall require the Contractor to cover the pipe ends with close woven bags until the start of the jointing operation.

2.00 MATERIALS

This item covers the types of materials that will be allowed for the construction and installation of sewer lines. All materials used shall be new, of the best quality available and conform with applicable standards as indicated herein.

2.01 Ductile Iron Pipe and Fittings. Only as approved by the Town.

2.02 Polyvinyl Chloride (PVC) Pipe and Fittings (Gravity Main)

A. PVC Pipe, through 15" diameter.

1. Material Reference Standard - ASTM D1784
 2. Pipe Reference Standard - ASTM D3034
 3. Class - SDR35
 4. Markings - Manufacturer's name, nominal size, PVC classification, Type PSM, SDR35, PVC gravity sewer pipe, ASTM D3034 and code number.
- B. PVC Pipe, 18" to 27" diameter.
1. Material Reference Standard - ASTM D1784
 2. Pipe Reference Standard - ASTM F679
 3. Markings - Manufacturer's name, nominal size, PVC cell classification, PS 46 PVC Sewer Pipe and ASTM F679.
 4. Variance - PVC piping meeting the stiffness requirement of ASTM F679 but not meeting wall thickness requirement will be allowed under this specification. Manufacturers will be required to provide a list of at least five (5) similar projects with references in which pipe has been successfully used and laboratory testing data showing the pipe meets the structural requirements of ASTM F679.
- C. Fittings
1. Type - PVC push-joint or mechanical joint
 2. Materials - ASTM D1784
 3. Reference Standard - ASTM D3034 or ASTM F679
- D. Joints
1. Type - push-on rubber gasket
 2. Gasket reference standard - ASTM F477

2.03 Force Main.

- A. PVC Pipe.
1. Materials - ASTM D 1784, Type 1, Grade 1, PVC 1120, 2000 psi design stress.
 2. Reference Standard - AWWA C-900.
 3. Class- 150 (DR-18).
 4. Markings - Manufacturer's name, nominal size, class pressure rating, PVC 1120, NSF logo, identification code.
 5. Specialties - Electrical tracing wire, 14 gauge solid copper insulated wire.
 6. Size - Shall conform to outside diameter of DIP.
- B. Fittings
1. Type - All fittings shall be mechanical joint except where specifically shown or detailed otherwise.
 2. Reference Standard - ANSI/AWWA C0110/A.21.10
 3. Pressure Rating - 250 psi
 4. Gasket Reference Standard - AWWA C-111

2.04 Concrete for Thrust Blocks and Encasing of Pipe. Concrete for thrust blocks and for

encasing the sewer pipeline shall have 28 day compressive strength of not less than 3000 psi.

2.05 Manholes.

A. Concrete Rings/Cones

1. Type - Precast
2. Reference Standard - ASTM C478
3. Size - Four-foot inside diameter

B. Manhole Bases

1. Shall be precast or cast-in-place, depending upon local jurisdiction standards, with integrally cast-in water stops. Tee tops of base shall be at least 12 inches above top of pipe.
2. Reference Concrete Standard - ASTM C150 Type II modified or Type V.

C. Manhole Steps

1. Material - Aluminum, ASTM C478
2. Size/Type - ½" round stock x 10" wide aluminum with slip-proof tread.
3. Mounting - Grouted in place on concrete ring with ASTM C150 Type II modified Portland Cement mortar and sand grout for water tight joint.

D. Joints

1. Type - Rub'r Nek preformed gasket as manufactured by K.T. Snyder Co., Inc., Houston, Texas or equal.
2. Cement Mortar Material Reference Standard - One part Portland Cement, Type II, modified with three parts of sand. Cement mortar to be used with concrete grade rings only.

E. Grade Adjustment Rings

1. Type - Precast ASTM C150 Type II modified concrete
2. Size - Not less than 6" wide x heights to allow for one inch adjustments.

F. Frame and Cover

1. Material Reference - Grey Iron, ASTM A48, Class 30
2. Cover - Stamped with "SEWER", machined bearing surface with ring
3. Type - Heavy, combined weight of ring and cover greater than 375 pounds.
4. Manufacturer Reference - Neenah, R-1706

2.06 Sewer Service Line Materials.

A. Wyes - Required for all new sewer line construction.

1. Material - ASTM D3034 PVC
2. Strength - for use with SDR35
3. Joint - Slip-on rubber gasket

B. Saddles (Required for tapping existing mains).

1. Material - ASTM D3034 PVC
2. Joint - Rubber seal to main with stainless steel compression bands. Slip-on service joint with rubber gasket.

2.07 Shear Gates. Not applicable.

2.08 Flat Gate. Not applicable.

2.09 Butterfly Valves. Not applicable.

2.10 Gate Valves. Not applicable.

2.11 Valve Boxes. Not applicable.

2.12 Tracer Wire. 14 gauge, insulated, solid copper wire. To be used on all force main installations.

3.00 METHODS AND PROCEDURES

3.01 Cleaning and Inspection. Clean all pipe, fittings and related materials thoroughly of all foreign material and inspect for cracks, flaws or other defects prior to installation. Mark all defective, damaged or unsound materials with bright marking crayon or paint and remove from job site.

The Contractor shall take all necessary precautions to prevent any construction debris from entering the sewer lines during construction. If this debris should enter the pipe line system, the Contractor shall furnish all labor and materials necessary to clean the system. Under no circumstances will the Contractor flush the debris into an existing sanitary sewer system.

3.02 Placement of Pipe.

A. Batter Boards. Not applicable

B. All pipe shall be installed to the line and grade as shown on the approved project drawings. Any changes must be approved by the Town through the project engineer. A minimum bury of four and a half (4 1/2) feet is required. Any variations from this must be submitted for approval in writing to the Town and approval given prior to installation. Any pipe found not to meet these requirements shall be relocated at the expense of the contractor.

C. Laser Beam. If bending of the beam due to air temperature variations becomes apparent with "in pipe" units, a fan shall be provided to circulate air in the pipe. Air velocity shall not be so excessive as to cause pulsating or vibrating of the beam. If, in the opinion of the Engineer, the beam cannot be accurately controlled, this method of setting line and grade shall be abandoned.

3.03 Pipe Embedment.

A. Placing embedment material - Refer to Section 2130 for placement methods.

B. Embedment Classes - Refer to Section 2130 and Construction Drawings for embedment materials for each class listed below:

1. Pipe shall be embedded according to applicable details of this manual and as shown on the Project Drawings.

3.04 Pipe Installation.

- A. Installation of Ductile Iron Pipe Lines. When approved by the Town, installation specifications shall be provided by the project engineer.
- B. Installation of Polyvinyl Chloride (PVC) Pipe.
 1. Pipe Handling. Pipe should be carefully lowered into the trench to avoid pipe falling into trench.
 2. Pipe Laying. Pipe shall be laid true to line and grade, in an uphill direction, with bell ends facing upstream. When pipe laying is not in progress, the open end of the pipe shall be closed by a watertight plug.
 3. Jointing the Pipe. The outside of the spigot and the inside of the bell shall be thoroughly wiped clean. Set the rubber ring in the bell with the marked edge facing toward the end of the bell. Lubricate the spigot end using a thin film of the manufacturer-supplied lubricant. Push the pipe spigot into the bell. Position the completed joint so that the mark on the pipe end is in line with the end of the bell.
 4. Pipe Cutting. The cutting of pipe for manholes or for fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe. Bevel the end of the pipe with a bevelling tool after the pipe is field cut. Place a clearly visible position mark at the correct distance from the end of the field-cut pipe.

3.05 Sewer Manhole Installation.

- A. General. Manholes shall be furnished and installed to depths and dimensions shown on the Drawings and/or staked in the field. Manholes shall be constructed of precast concrete rings in accordance with details shown on the Drawings.
- B. Connections to Manholes. The first length of sewer pipe into and out of any manhole shall be a maximum of 24" as measured from the inside face of the manhole to the end of the pipe. In addition, extra care shall be taken by grouting or other means of sealing to assure positive water-tight manholes around the inlet or outlet pipes. Expandable water stops, special sleeves or a rubber gasket cemented to the sewer pipe shall be used. All pipe shall be grouted in place with non-shrink grout.
- C. Manhole Floor and Inverts. Manhole bases shall be constructed to conform to the details shown on the Drawings. The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the incoming and outgoing sewer pipelines. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. Where large differences in invert elevations exist, sloped flow channels shall be formed so the wastewater does not undergo a vertical drop. The invert channels may be formed directly in the concrete

of the manhole base. The floor of the manhole outside the channel shall be smooth and shall slope toward the channels.

- D. **Finish Grade and Adjustment.** To bring the manhole cover to the correct elevation, the top section of each manhole shall be constructed of pre-cast concrete grade adjustment rings. These rings shall be not less than six inches (6") wide and furnished in heights to allow for two inch (2") adjustments. Grade adjustment with rings shall be eight inches (8") maximum and two inches (2") minimum. All rings shall be grouted in place.
- E. **Manhole Stubs.** All pipe stubs required from manholes are shown on the Drawings. Stubs shall extend approximately 24" from the outside face of the manhole and shall be capped or plugged with manufactured fittings to form a water-tight installation.

3.06 **Connection to Existing Sewer Facilities.** Connections to existing sewer facilities where live flows exist shall be made only after prior consultation with and receipt of written permission from the Engineer. No bypass of sewage to the surface will be allowed in the completion of this connection. Connections shall be made as shown on the Drawings. All connections between pipes of different materials shall be made with approved manufactured connectors.

3.07 **Protection of Water Supplies.** Sewer lines shall be located a minimum of ten feet (10') horizontally from existing or proposed water mains. Where the sewer line crosses above the waterline, or is less than eighteen inches (18") vertically below the invert of the water line, or is less than ten feet (10') horizontally from the water main, the sewer line shall be made impervious by the method listed below:

- A. The sewer pipe shall be reinforced with a concrete encasement. The encasement shall be at least six inches (6") thick on all sides of the sewer pipe and extend ten feet (10') on either side of the water main. Use three No. 4 rebar the length of the encasement.

If clearance is less than 12 inches vertically, the space between the water and sewer mains shall be filled by 3000 psi concrete.

In all cases, bedding material shall be used to prevent any settling of the higher pipe.

3.08 **Service Connections.** Customer service connections shall be installed in accordance with the details set forth on the construction Drawings. After the service connection is installed, the end shall be plugged water-tight with a manufactured plug and marked with a metal fence post or metal stake extending a minimum of three feet above finish grade except as shown otherwise on the Drawings. A #2 wire shall be securely attached to the post and the end of the service pipe.

3.09 **Detection Tape.** Not required.

4.00 **FIELD QUALITY CONTROL**

4.01 **Alignment and Grade.** Sewer pipelines will be checked by the Engineer to determine whether any displacement of the pipe has occurred after the trench has been backfilled. The test will be as follows:

A light will be flashed between manholes, or if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight. If the

illuminated interior of the pipeline shows poor alignment, displaced pipe, earth or other debris in the pipe, or any other kind of defect, the defects determined by the Engineer shall be remedied by the Contractor at his own expense. Test will be repeated after completion of backfilling and any poor alignment, displaced pipe, or other defects determined by the Engineer, shall be corrected.

In addition to the above, the Owner shall, at his option and at his expense, televise the interior of the line prior to acceptance. All defects shall be noted and corrected as stated above.

4.02 Leakage Test. Sewerlines shall be tested using a low pressure air test only; water tests will not be allowed. Only after the sanitary sewers, including appurtenances and sanitary laterals have been installed, backfilled and cleaned, shall the Contractor proceed with an air test on the installed facilities.

- A. Low Pressure Air Test Procedure. The section of sewerline to be tested should be flushed and cleaned prior to conducting the low pressure air test. This serves to clean out any debris, wet the pipe, and produce more consistent results. Isolate the section of sewerline to be tested by means of inflatable stoppers or other suitable test plugs. One of the plugs should have an inlet tap, or other provision for connecting a hose to a portable air control source.

If the test section is below the groundwater level, determine the height of the ground water above the spring line of the pipe at each end of the test section and compute the average. For every foot of groundwater above the pipe spring line, increase the gauge test pressure by 0.43 pounds per square inch. Connect the air hose to the inlet tap and a portable air control source. The air equipment should consist of necessary valves and pressure gates to control the rate at which air flows into the test section and to enable monitoring of the air pressure within the test section. Also, the testing apparatus should be equipped with a pressure relief device to avoid the possibility of loading the test section with the full capacity of the compressor.

Add air slowly to the test section until the pressure inside the pipe is raised to 4.0 psig greater than the average back pressure of any groundwater that may be over the pipe. After a pressure of 4.0 psig is obtained, regulate the air supply so that the pressure is maintained between 3.5 and 4.0 psig (above the average ground water back pressure) for a period of two minutes. This allows the air temperature to stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until temperature equilibrium is obtained.

Determine the rate of air loss by the time/pressure drop method. After the two minute air stabilization period, the air supply is disconnected and the test pressure allowed to decrease to 3.5 psig. The time required for the test pressure to drop from 3.5 psig to 3.0 psig is determined by means of a stopwatch and this time interval is then compared to the required time in the attached table to determine if the rate of air loss is within the allowable time limit. If the time is equal to or greater than the times indicated in the tables, the pipeline shall be deemed acceptable.

MINIMUM DURATION FOR AIR TEST PRESSURE DROP

Pipe Size		Time
<u>Inches</u>	<u>mm.</u>	<u>Minutes</u>

4	100	2½
6	150	4
8	200	5
10	225	6½
12	305	7½
15	380	9½

Upon completion of the test, open the bleeder valve to allow air to escape. Plugs should not be removed until all air pressure in the test section has been released. During this time, no one should be allowed in the trench or manhole while the pipe is being decompressed. Air test shall also include service lines and appurtenances.

4.03 Manhole Inspection. During the construction of the manholes, the Contractor shall, in accordance with good practice, ensure that no earth, sand, rocks or other foreign material exists on the joint surfaces during assembly of the section. The Engineer shall check each manhole to determine whether the manhole fulfills the requirements of the Drawings and Specifications.

- A. Visual Examination. The Engineer shall visually check each manhole, both exterior and interior, for flaws, cracks, holes, or other inadequacies which might affect the operation or water-tight integrity of the manhole. Should any inadequacies be found, the Contractor, at his own expense, shall make any repairs deemed necessary by the Engineer.
- B. Leakage Test. All manholes shall be tested for leakage and all tests shall be witnessed by the Engineer. The leakage test shall be conducted prior to backfilling around the manhole and shall be carried out in the following manner:
 - 1. All lines leading into or out of the manhole shall be tightly plugged.
 - 2. The manhole shall be filled with water to a level of at least one foot above the uppermost joint. The water shall be allowed to stand for two hours to allow for normal water absorption into the manhole material. The test shall be run for at least two hours. The amount of water required to refill the manhole shall be measured as the manhole is refilled at the end of the test. The depth of the manhole shall be considered as the in-place measurement between the invert of the sewer and the rim of the casing. This depth measurement multiplied by the allowable leakage rates in the table below yields the maximum allowable amount of water required to refill the manhole at the end of a two-hour test.

MAXIMUM ALLOWABLE MANHOLE LEAKAGE
(Two-hour Test)

<u>Diameter of Manhole (Inches)</u>	<u>Leakage Gal/Vertical Ft/2 Hours</u>
48	0.08
60	0.10

4.04 Deflection Test for Non-Rigid Pipe. The maximum allowable pipe deflection for a completely backfilled, non-rigid sewer pipe shall not exceed five percent (5%) of the nominal internal pipe diameter. Deflections in non-rigid pipe shall be checked by measurement or by pulling a mandrel

with the minimum allowable diameter through the pipe. The minimum allowable diameter shall be equal to the minimum interior diameter of the pipe, as specified in the applicable portions of the ASTM Standard Specifications or the pipe manufacturer's recommendations, minus five percent of the minimal interior diameter of the pipe. Those sections of non-rigid pipe with deflections greater than the maximum allowable five percent shall not be acceptable and the Contractor will remove and replace these sections at his own expense.

Deflection tests will be run if in the opinion of the Town testing is warranted. The program for testing shall be determined by the Town. The Contractor shall furnish all labor, tools and equipment necessary to make the tests and to perform any work incidental thereto.

End of Section