

## SECTION 802

### SANITARY GRAVITY SEWER SYSTEMS

#### **I. GENERAL**

##### **1.1. DESCRIPTION OF WORK**

The Contractor shall furnish all labor, supervision, material (except as herein provided), tools, equipment, supplies, and services; and, shall perform all Work necessary for the construction of gravity sanitary sewer systems up to 24-inch in diameter. The gravity sanitary sewer systems shall be constructed in accordance with the Contract Documents and the applicable laws, rules, ordinances, standards, and specifications of regulatory agencies.

##### **1.2. SUBMITTALS**

Submittals shall be made by the Contractor in accordance with the procedures set forth in Section 105 and as described below:

- A. Provide a construction schedule for approval that includes the sequence of installation of casings, pipelines and manholes. Provide a laying schedule (on the Drawings) that show necessary deviations from the Contract Documents due to specific utility conflicts discovered during required exploratory excavations.
- B. Submit each manufacturer's and/or supplier's certification(s) attesting that the pipe, gaskets, manholes, castings, and appurtenances meet or exceed the specified requirement. The following information is to be shown on each certificate:
  1. Name and location of the work
  2. Name and address of Contractor
  3. Quantity and date or dates of shipment and/or delivery to which the certificate applies.
  4. Name of the manufacturing or fabricating company.
  5. Type B manhole coatings shall be warranted for materials and workmanship for a minimum of 5 years.
- C. Certification shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating, or supplying company.

If requested by the Owner, all laboratory test reports shall be provided at no additional cost showing the following information:

1. Date or dates of testing
2. The specified requirements for which testing was performed.
3. Name and location of the testing agency.
4. Results of the test or tests.

- D. Manufacturer's catalog cuts, technical data, operation and maintenance data, and/or shop drawings are required for the following gravity sewer system components (shop drawings shall be drawn to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work):

1. Pipe and fittings
2. Manholes
3. Frame and Covers
4. Clean-outs
5. Steps (where required)
6. Manhole Connections

E. Manhole Coatings:

1. Manufacturer's submittals:
  - a. Material Safety Data Sheets (MSDS) for each product used.
  - b. Manufacturer's requirements, including application procedures, shall be in writing.
  - c. Storage requirements including temperature, humidity, and ventilation for coating materials.
  - d. Recommended concrete surface profile (CSP) values, including methods for obtaining the required profile; proposed methods for maintaining all environmental controls and for containing, collecting, and disposing of residuals.
  - e. Manufacturer's certification that materials comply with Federal, State, and Local regulations for VOC (Volatile Organic Compounds).
  - f. Letter(s) with associated product data signed by Manufacturer certifying that submitted products are suitable for application on the surfaces to be coated and for the service conditions.
  - g. Certification that Applicator personnel have been trained and approved in the handling, mixing and application of the products to be used.
  - h. Certification that the equipment to be used for applying the products has been approved and calibrated and Applicator personnel have been trained and certified for proper use of the equipment.
2. Applicator Requirements:
  - a. Two (2) years' experience and five (5) recent references of projects of similar size and scope.
  - b. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, ICRI and SSPC standards and the protective coating manufacturer's recommendations.
  - c. Applicator shall conform to all local, state and federal regulations including those set forth by OSHA, RCRA and the EPA and any other applicable authorities.

3. Prior to substantial completion, the Contractor shall provide to the Owner "Manhole/Structure Protective Coating Post Installation Certification" form (see Section 109) completed by the Applicator and coatings manufacturer which includes the following information:
  - a. All manhole and structures were coated in conformance with the coating manufacturer's recommendations.
  - b. The value of the concrete surface profile of the manhole/structure complied with the coating manufacturer's CSP recommendations.
  - c. Ambient conditions, including temperature and humidity.
  - d. The concrete surface was clean and free of all deleterious materials.
  - e. The concrete moisture levels at the time of coating applications were within acceptable levels as recommended by the coating manufacturer.
  - f. Average and minimum dry film thickness of the coating.
  - g. Recoat intervals.

#### F. Polymer Concrete Manholes

In addition to the manhole submittal requirements identified above, Polymer Concrete Manholes shall also require the following submittals:

1. Polymer concrete manholes shall be manufactured in accordance with Section 200.
2. Calculations signed and sealed by a Professional Engineer demonstrating the manhole meets the design requirements for its intended location and service duty. As a minimum material properties, polymer mixture, loadings, load combinations and dimensioned assumed.
3. Shop drawings for each manhole including the Owners number, location, rim and invert elevations, dimensions, reinforcing details, manhole sections, bench and invert materials, base units and construction details, and jointing details and materials.
4. Handling and shipping shall be performed in accordance with the manufacturer's instructions.
5. Each manhole shall be marked on the inside and outside with the Manufacturer's name or trademark, manufacturer's location and production date.
6. Certification that the manufacturer of Polymer Concrete manholes has been actively producing polymer concrete manholes for a minimum of 5 years with no more than one year between manholes projects. References demonstrating this requirement shall also be provided.
7. Polymer concrete manholes shall be manufactured by U.S. Composite Pipe, Inc. or Owner approved equal.

## **II. EXECUTION**

### **2.1. GENERAL**

- A. The Contractor shall furnish and install a complete system as shown in the Contract Documents. Pipe shall be laid true to lines and grades except as authorized by the Owner.
- B. The Owner reserves the right to reject defective material shipped to and/or stored on site, and to examine pipe and determine if the pipe is damaged prior to installation.
- C. The Contractor shall unload, handle, and store pipe and appurtenances in accordance with Section 200 of these Standards and the manufacturer's recommendations.
- D. Proper tools and facilities satisfactory to the Owner and as recommended by the material manufacturer shall be provided and used by the Contractor for the safe and convenient prosecution of the Work. All pipe, fittings, manhole sections, frame and covers, and accessories shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, slings, or other suitable tools or equipment in such a manner as to prevent damage to the material and any protective coatings and linings.

### **2.2. PIPE INSTALLATION**

- A. Cleaning: All lumps, blisters and excess coatings shall be removed from the bell and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be cleaned, dry, and be free from oil, grease, dirt, sand, grit, or any foreign materials before the pipe is installed.
- B. Trenching, bedding, backfilling and compaction shall be in accordance with Section 303.
- C. Pipe Laying:
  - 1. Pipe shall be laid to a true, uniform line and grade. The pipe shall be installed on a straight line between manholes (or to a clean-out box), without dips or bends. Laying of pipe shall be accomplished only after the trench has been dewatered and the foundation and/or bedding has been prepared in accordance with the Standard Details for the type and class of foundation or bedding specified.
  - 2. Pipe laying shall be in accordance with the manufacturer's recommendations. Pipe laying shall proceed upgrade, bells ahead. Each section of pipe shall be laid to form a close concentric joint with the adjoining section and to prevent sudden offsets in the flow line. Each section of pipe, as it is laid, shall be backfilled as specified in the Contract Documents, at least up to the centerline to adequately hold the pipe in place, before the next joint is made.
  - 3. A laser shall be used to maintain line and grade. A ventilating fan may be required to be used in conjunction with the laser beam to preclude fumes or air conditions that may cause refraction. A copy of the certification of the laser calibration shall be provided for each separate job prior to the beginning of pipe installation.
  - 4. As the Work progresses, the interior of the pipe shall be cleared of dirt and superfluous material.

5. Trenches and other excavations shall be kept free of water until backfilled. Concrete or masonry Work shall not be constructed in water, nor shall water be allowed to rise over the Work until concrete or mortar has had ample time to set.
6. When work is not in progress, open ends of pipe and fittings shall be closed so that trench water, earth, and other substances will not enter the pipe or fittings.
7. Whenever a pipe requires cutting to bring it to the required location, the Work shall be performed in a satisfactory manner so as to leave a beveled end in accordance with the manufacturer's instructions or recommendations. Cuts shall be made at 90° with the centerline of the pipe so that a framing square placed against the side of the pipe will reveal not more than 1/4-inch variation across the diameter of the pipe in any direction. The pipe shall be cut with an abrasive wheel, rotary wheel cutter, guillotine pipe saw, milling wheel saw or other equipment specifically designed for that purpose. The Contractor shall grind smooth cut ends and rough edges and for push-on connections; the cut ends should be beveled slightly. Pipe damaged by the Contractor in cutting shall be replaced at the Contractor's expense.
8. Laying of the pipe shall commence immediately after the excavation is started, and every means must be used to keep pipe laying closely behind the trenching. Holes shall be scooped out where the bells occur leaving the entire barrel of the pipe bearing on the pipe bed. No more than 100 feet of trench shall be open in advance of pipe laying, unless approved by the Owner. The excavation of the trench shall be fully completed a sufficient distance in advance of the laying of the pipe.
9. Pipe joint assembly practices and joint assembly materials such as lubricants, primers and adhesives shall be in accordance with the manufacturer's recommendations and specifications.
10. Pipe shall not be laid on frozen bedding.

D. Alignment and Grade:

1. The Contractor shall not deviate from the line and grade indicated in the Contract Documents, except with approval of the Owner.
2. The sanitary sewer system shall be installed according to the following tolerances:
  - a. The maximum deviation of any invert from plan grade shall be within +/- 0.05 feet.
  - b. The total deviation of both inverters at each end of a particular line shall be within +/- 0.08 feet.
  - c. The maximum slope deviation between any two points in the line from the plan slope shall be +/- 0.02 %.

2.3. MANHOLE INSTALLATION

A. Prior to installation, the Owner shall inspect manholes for direction and sizes of openings, cleanliness, joints, and handling damage and cracks. Manholes determined to be defective by the Owner shall be replaced by the Contractor.

- B. Manholes located within a distance of 250 linear feet of pipe away from a pump station discharge shall be considered to have a higher risk for corrosive degradation. When indicated on the Bid form polymer concrete or non-standard type manholes and frames shall be installed in lieu of standard manholes, frames and coatings unless otherwise approved by the Owner.
- C. Manholes shall be constructed promptly as the sections of the sewer between them are completed.
- D. The Contractor shall join pipe to the manhole in accordance with the Drawings, Standard Details, and the manufacturer's requirements. Pipe stubs shall extend beyond the manhole as indicated in the Contract Documents and shall be sealed with a watertight plug or cap.
- E. Manhole bedding shall be as specified in the Standard Details. Concrete for manhole foundations shall be in accordance with the Standard Details and as specified under Section 502.
- F. The top of all manholes shall be brought to proper grade for receiving frames and covers.
- G. The manhole frame rim shall be free of all dirt and debris prior to the installation of the manhole insert. The insert shall be fully seated around the manhole frame rim to insure against water seepage between the insert and the manhole frame rim. Gasket lubricant, such as used in water and sewer main installation, shall be applied generously on the gasket prior to installing the insert.
- H. Existing manholes and main line cleanouts requiring frame and cover adjustment rings for pavement overlay applications shall be performed in accordance with Section 510.
- I. Manhole Coatings:

*(This specification covers the execution processes required for protecting concrete manholes and other underground structures using epoxy-coating systems, per Section 200 and this Section. The Engineer is responsible for determining the level of protection required and is cautioned that the coating system recommendations contained herein may not be suitable for every application. Each project and structure should be evaluated independently and the level of protection determined based on the product, service environment and protection level, as a minimum.)*

#### 1. Surface Preparation

Surface preparation is the process by which sound, clean, and suitably roughened surfaces are produced on concrete substrates. This process includes the removal of unsound concrete and bond-inhibiting films, strength verification, opening the pore structure, verification of moisture content, and establishing profiles suitable for the application of the specified protective system.

The Contractor and Applicator must abide by all environmental controls and requirements specified in the Contract Documents during surface preparation and coatings application. Excess dust, noise, vibrations, and the loss from the job site of concrete dust and slurries must be avoided. Slurries must be contained, collected, and disposed of in an Owner approved method. If Contractor and applicator fail to adequately control emissions from the work site, Owner may take all necessary corrective actions and withhold the costs for such from monies due the Contractor.

The Contractor shall abide by all VOSHA and other applicable work area safety and protection requirements during surface preparation activities.

- a. Installation of the epoxy coating shall not commence until the concrete substrate has properly cured and prepared in accordance with coatings manufacturer's recommendations.
- b. All contaminants including: oils, grease, unsound or incompatible existing coatings, waxes, form release agents, curing compounds, efflorescence, sealers, salts, concrete dust, or other contaminants shall be removed.
- c. All concrete that is not sound or has been damaged shall be removed to a sound concrete surface or replaced.
- d. Temperature of the surface to be coated should be maintained between 40° F and 120° F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, care should be taken to apply the coating when the surface temperature is falling versus rising.
- e. Applicator shall inspect all specified surfaces prior to surface preparation. Applicator shall notify the Contractor and the Owner within 24 hours of all manholes/structures:
  - (1) whose concrete is not sound or has been damaged.
  - (2) or are not otherwise suitable for surface preparation.
- f. Once the Applicator and Contractor are in agreement that the surfaces to be coated are in accordance with the product manufacturer's requirements, Contractor shall notify Owner. The Owner, at its discretion, may then perform inspections as necessary to assure that the structure is ready for the application of the coating system.
- g. Should any surface be found to be inadequate for acceptance of coating, or should the structure fail to meet the structural requirements of the referenced specifications, such structures shall be either repaired to the complete satisfaction of the Owner or removed from the project site and replaced with a new structure, all at no expense to the Owner. Replacement structures shall be subject to the same requirements for structural integrity and surface preparation.

## 2. Application Requirements

- a. Application procedures shall conform to the recommendations of the coating Manufacturer, including material handling, mixing, environmental controls during application, safety, and application equipment.
- b. Unless specified elsewhere herein, the Applicator shall comply with the Manufacturer's most recent written instructions with respect to the following:

- (1) Mixing of all materials.
- (2) Storage, protection and handling of all materials.
- (3) Surface preparation has been properly performed and surfaces brought to the appropriate CSP profile.
- (4) Recoat limitations and cure times.
- (5) Minimum ambient, substrate and atmospheric temperatures, substrate's degree of dryness, relative humidity, and dew point of air.
- (6) Application.
- (7) Final curing.
- (8) Use of proper application equipment.
- (9) Cleanup and disposal

- c. The Applicator must follow the minimum and maximum recoat limitation times and related temperature range restrictions between successive lifts, per Manufacturer's stated requirements.
- d. The applied coating system shall be protected from damage during curing and shall be cured as recommended by the Manufacturer. Ambient conditions shall be controlled and maintained during curing as required by the Manufacturer.
- e. The Applicator shall be responsible for coating all openings, including the top of manhole cone and pipe penetrations; and, joints (following field application of grouting). Any deficiencies in the finished coating shall be repaired by the Applicator according to the procedures provided by the coating Manufacturer.
- f. For the Type of Coating specified, surfaces shall be coated to a minimum dry film thickness of:
  - (1) Type A Coating – 40 mils, and
  - (2) Type B Coating – 80 mils.

## 2.4. TESTING AND INSPECTION

### A. General:

- 1. All flushing, air, vacuum, or infiltration testing procedures shall conform to this Section and the applicable sections of the Commonwealth of Virginia *SCAT Regulations, latest edition*.
- 2. The Contractor shall request the Owner at least 48 hours (2 working days) notice to schedule testing and inspection.
- 3. Only properly functioning and clean equipment shall be used for cleaning and testing gravity sewer systems.

4. Connections to existing sewer facilities will be permitted only after satisfactory completion of testing and cleaning, and only when authorized by the Owner.
5. All testing activities require compliance with the Occupational Safety and Health Agency (OSHA) in regard to confined space entry.
6. The Contractor is responsible for repairing any deficient Work at no additional cost to the Owner.

B. Pipe Testing - Gravity Lines:

1. New gravity sewer systems will be tested using the following procedures:
  - a. Visual Test - All manhole covers shall be removed by the Contractor as a prerequisite to conducting the visual test. The Contractor shall certify that all manhole entries are in compliance with confined space entry procedures and mechanical ventilation shall be provided. A visual inspection shall consist of the following:
    - (1) Inspection for visible leaks in lines or manholes
    - (2) Inspection of condition of the grout in the interior joints of manholes
    - (3) Inspection of manhole frames and covers for proper type and installation
    - (4) Inspection to see if lines are free of debris
    - (5) Inspection of manhole benches and invert
    - (6) Check of alignment and grade by introducing sufficient water into the line to verify the absence of sags, or as directed by the Owner
    - (7) Check that manholes have been completely and properly coated on all surfaces
    - (8) Mirror test the line
  - b. Deflection Test - The entire length of all flexible gravity sanitary sewer lines shall be tested by means of a rigid mandrel to assure that deformation or deflection does not exceed 5 percent of the base inside diameter per ASTM D3034. An Owner-provided mandrel will be manually pulled through the line by the Contractor in the presence of the Owner, no sooner than 30 days after completion of backfill. The mandrel contact length will be equal to the nominal diameter of the pipe. The mandrel, one for each size of pipe, shall be a nine-arm mandrel, with a proving ring sized at 5 percent of the base inside diameter. Contractor is responsible for removal of mandrel if it becomes stuck in the pipe. Lines must be free of debris for this test and the Contractor shall be responsible for installing a string line in the pipe for the test. Any sections that do not pass the test shall be corrected or replaced by the Contractor. Ductile iron pipe will not be required to have a deflection test performed.

c. Leakage Testing

The Contractor shall perform one of the following leakage tests as required by the locality.

(1) Low Pressure Air Test:

- (a) An air test conforming to ASTM Specification F1417, shall be performed on all gravity sewer mains, including service laterals and cleanouts, prior to acceptance. The Contractor is responsible for supplying an air-testing rig and pressure gauge, calibrated to the tenth of a pound, for this test.
- (b) The Contractor shall furnish all the necessary equipment and be responsible for conducting all low-pressure air tests. The Owner shall witness all low-pressure air tests and verify the accuracy and acceptability of the test and the equipment utilized. The Contractor is responsible for any repair work on sections that do not pass the test.
- (c) After a manhole-to-manhole reach of pipe has been backfilled to final grade and prepared for testing, plugs shall be placed in the line at each manhole and secured. Once the plugs are in place and the air hoses connected, the plugs shall be inflated and the sewer line pressurized to the test pressure.
- (d) All plugs shall be installed and properly inflated to prevent blowout. All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valves set no higher than nine (9) pounds per square inch gauge to avoid over-pressurizing and displacing temporary or permanent plugs. No person shall enter a manhole while air is being forced into a pipe with plugs in place or when any pressure remains behind the plugs.
- (e) All plugs shall be capable of resisting internal testing pressures without the aid of external bracing or blocking. If pneumatic plugs are utilized, a separate hose is required to inflate the pneumatic plugs from the aboveground control panel. To facilitate test verification by the Owner, all air used shall pass through a single, aboveground control panel. The above-ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from zero (0) to at least ten (10) psig. The gauge dial shall be divided in 0.1 psi or smaller increments. The gauge shall have an accuracy of 0.04 psi. Two separate hoses shall be used (in addition to hose for pneumatic plugs) to: (1) connect the control panel to the sealed line for introducing low-pressure air, and (2) a separate

hose connection for constant monitoring of air pressure build-up in the line.

- (f) All service laterals, clean-outs, stubs, and fittings within the sewer test section shall be properly capped or plugged during construction to prevent air loss that could cause an erroneous air test result.
- (g) Air shall be supplied slowly to the section of the sewer being tested until the internal pressure reaches 4.0 psig greater than the average back pressure of groundwater above the pipe, but not greater than 9.0 psig. The groundwater adjustment shall be calculated by dividing the average vertical height, in feet of groundwater above the invert of the sewer pipe to be tested, by 2.31. The result gives the adjustment in pounds per square inch that must be added.
- (h) After an internal pressure of 4.0 psig (plus required groundwater adjustment) is obtained, allow at least two minutes for air temperature to stabilize.
- (i) After two minutes, the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased by no more than 0.5 psig. At a reading of 3.5 psig (plus required groundwater adjustment not to exceed 9.0 psig), timing shall commence. The watch or timing device shall be stopped and read when the pressure drops 1.0 psig and the time (in seconds) shall be recorded.
- (j) If the time shown in Table 802-1 for the designated pipe size and length elapses before the air pressure drops 1.0 psig, the section undergoing testing shall have passed and shall be presumed to be free of defects. If the section fails to meet these requirements, the Contractor shall determine at its own expense the source or sources of leakage, and shall repair or replace all defective materials and/or workmanship to the satisfaction of the Owner. The completed pipe installation shall then be retested until the requirements of this test are met.

(2) Infiltration

- (a) Infiltration Test - will be conducted if the Contractor proves to the satisfaction of the Owner that the water table is high enough to conform to the requirements noted below.

The level of the groundwater shall be at least 4 feet above the top of the sewer line along the entire section of the pipeline to be tested. Measurements shall be made every hour for three hours to determine the amount of infiltration

(b) Infiltration shall not exceed 25 gallons per day per mile of sewer per inch of pipe diameter. There shall be no visible leaks.

d. Remote Camera / TV Inspection

Post-Installation TV inspection shall not be completed until all Work, including service laterals, manholes, and main line cleanouts are complete on a section of line. The post-installation TV inspection documentations (tapes, CDs, DVDs, storage portable storage devices, etc.) shall be submitted to the Owner prior to substantial completion, or when requested.

The Contractor shall engage and pay for television inspection for all gravity sewers installed, including service laterals and cleanouts. The Owner shall be present during the inspection. The inspections shall conform to the National Association of Sewer Service Companies (NASSCO) recommended specification for television inspections for main sewers.

Lines shall be cleaned prior to inspection. Prior to inserting the television camera into the pipeline, the Contractor shall flush and clean the pipeline. The Contractor shall introduce a minimum of 1,000 gallons of clear, potable water into the terminal upstream manhole or last access structure on any given gravity sewer branch of the pipeline to be inspected with a television camera. The Contractor is responsible for acquiring, collecting and disposing of the water, at no additional cost to the Owner.

The video inspection equipment shall conform to the requirements of Section 811. A video recording of inspected gravity sewer mains, service laterals, and cleanouts shall be provided to the Owner in electronic format on an Owner-approved data transfer format upon completion of the inspection. The format shall comply with the requirements of Section 811. A log of comments made on the video shall be supplied with the associated pipe footage shown.

If the television inspection of the pipe shows poor alignment, displaced or cracked pipe, improper joints or slipped gaskets, the defect(s) shall be corrected and the pipe line re-videoed.

**TABLE 802 -1**  
**AIR TEST TABLE**  
**(Based on ASTM F1417)**

Minimum Test Time in Minutes: Seconds  
For Pressure Drop from 3.5 to 2.5 Psig (Minus Groundwater Influence)

| Pipe Dia., In. | Minimum Time, Min. | Length for Minimum Time, Ft. | Time for Longer Lengths | Specification Time for Length (L) Shown, Minutes |        |        |        |        |        |        |        |
|----------------|--------------------|------------------------------|-------------------------|--|--------|--------|--------|--------|--------|--------|--------|
|                |                    |                              |                         | 100 Ft   | 150 Ft | 200 Ft | 250 Ft | 300 Ft | 350 Ft | 400 Ft | 450 Ft |
| 4              | 3:46               | 597                          | 0.380L                  | 3:46   | 3:46   | 3:46   | 3:46   | 3:46   | 3:46   | 3:46   | 3:46   |

| Pipe Dia., In. | Minimum Time, Min. | Length for Minimum Time, Ft. | Time for Longer Lengths | Specification Time for Length (L) Shown, Minutes |        |        |        |        |        |        |        |
|----------------|--------------------|------------------------------|-------------------------|--|--------|--------|--------|--------|--------|--------|--------|
|                |                    |                              |                         | 100 Ft   | 150 Ft | 200 Ft | 250 Ft | 300 Ft | 350 Ft | 400 Ft | 450 Ft |
| 6              | 5:40               | 398                          | 0.854L                  | 5:40   | 5:40   | 5:40   | 5:40   | 5:40   | 5:40   | 5:42   | 6:24   |
| 8              | 7:34               | 398                          | 1.520L                  | 7:34   | 7:34   | 7:34   | 7:34   | 7:36   | 8:52   | 10:08  | 11:24  |
| 10             | 9:26               | 239                          | 2.374L                  | 9:26   | 9:26   | 9:26   | 9:53   | 11:52  | 13:51  | 15:49  | 17:48  |
| 12             | 11:20              | 199                          | 3.418L                  | 11:20  | 11:20  | 11:24  | 14:15  | 17:05  | 19:56  | 22:47  | 25:38  |
| 15             | 14:10              | 159                          | 5.342L                  | 14:10  | 14:10  | 17:48  | 22:15  | 26:42  | 31:09  | 35:36  | 40:04  |
| 18             | 17:00              | 133                          | 7.692L                  | 17:00  | 19:13  | 25:38  | 32:03  | 38:27  | 44:52  | 51:16  | 57:41  |
| 21             | 19:50              | 114                          | 10.470L                 | 19:50  | 26:10  | 34:54  | 43:37  | 52:21  | 61:00  | 69:48  | 78:31  |
| 24             | 22:40              | 99                           | 13.674L                 | 22:47  | 34:11  | 45:34  | 56:58  | 68:22  | 79:46  | 91:10  | 102:33 |

Note: If the groundwater level is 2 ft. 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 gauge, this air testing practice should not be used. Before this air testing practice is used, the groundwater level should be lowered by pumping or dewatering.

C. Manhole Testing:

1. All manholes shall be vacuum tested by the Contractor prior to acceptance.
  - a. Vacuum Test:
    - (1) The vacuum test shall be in accordance with ASTM C1244.
    - (2) All pipe entries into the manhole shall be plugged. The compression band of the manhole vacuum testing equipment shall be inflated to create a seal between the vacuum equipment base and the top of the manhole.
    - (3) If the Contractor backfills around the manhole prior to testing, ten (10) inches of mercury shall be applied to the manhole and the time measured for the vacuum to drop from 10-inches to 9-inches shall be recorded. The test duration for a 48-inch diameter manhole is 60 seconds; the test duration for a 60-inch diameter manhole is 75 seconds.
  - b. If the vacuum drop is greater than 1-inch of mercury during the test period, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test.
  - c. Appropriate consideration/adjustment shall be given to manholes that have been backfilled prior to the vacuum test per ASTM C1244.
2. Coating systems shall be tested during coating applications and after manholes have been installed.

- a. During coating the Applicator shall regularly perform and record coating thickness using a wet film thickness gauge meeting ASTM D4414 – *Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gauges*, to ensure a monolithic coating and uniform thickness during application. A minimum of three (3) readings per 200 square feet of surface area shall be recorded. Applicator shall submit documentation on thickness readings to the Owner on a daily basis when coating application is underway.
- b. For Type B coatings, the applicator shall perform holiday testing on all coated surfaces in the presence of the Owner. After the coating has dried and set hard to the touch, an induced holiday shall then be introduced on the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at the particular area.
- c. The spark tester shall be initially set at 100 volts per 1 mil of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional coating material can be hand applied to the repair area. All touch-up and repair procedures shall follow the coating manufacturers recommendations.
- d. After manholes have been installed and all required testing of coatings and assembly have been performed, the Owner will perform a visual test to verify that no damage to the coating system occurred during installation. Any deficiencies in the finished coating shall be marked and repaired by the Applicator according to the procedures provided by the coating Manufacturer.

## 2.5. CONNECTIONS

General:

- A. All materials shall be installed in accordance with ASTM C-923 and the manufacturer's recommendations and the Standard Details.
- B. Core drilling and flexible pipe-to-manhole connectors shall be used when connecting sewer pipe to existing manholes unless otherwise approved by the Owner. The connector shall be as specified in Section 200. Connectors shall be of a size specifically designed for the class and type of pipe and manhole type.
- C. Connections shall only be made in the presence of the Owner.

## 2.6. MANHOLE COATINGS WARRANTY

Following the successful application and acceptance of Type B coatings by the Owner, the coatings manufacturer shall warrant all Work against defects in materials and workmanship for a period of five (5) years, unless otherwise noted. Warranty shall begin at the date of substantial completion of the project. Coatings Manufacturer shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship that may develop during the warranty period. The coatings Manufacturer shall be responsible for all costs necessary and associated with the repair of defects or the repairing of same, including traffic and environmental controls, at his sole expense.

### **III. MEASUREMENT FOR PAYMENT**

#### **A. Gravity Sewer Pipe, installed complete in place.**

1. Measurement of the gravity sewer pipe will be made along the centerline of the pipeline, based upon the linear footage and depth of each size pipe and material type installed and satisfactorily tested. Pipe will be measured to the centerline of the manholes or cleanouts.
2. Measurement shall be made at the following depth classifications: 0-6, 6-8, 8-10, 10-12, 12-14, 14-16, 16-18, 18-20, and greater than 20 feet, in accordance with Standard Detail EW\_02.
3. Payment will include the cost of the following:
  - a. Backfilling, compacting, and compaction testing,
  - b. Bedding as detailed in the Contract Documents,
  - c. Bypass pumping(up to 2mgd),
  - d. Clearing,
  - e. Connection of existing laterals, manholes connections and drop connections when replacing existing sewer in the same trench,
  - f. Dewatering,
  - g. Disposal of surplus material,
  - h. Excavation (per depth classification),
  - i. Flushing,
  - j. Gravity sewer main and appurtenances,
  - k. Main line fittings,
  - l. Post-installation video inspection,
  - m. Protection of existing utilities,
  - n. Removal and legal disposal of existing sanitary sewer main and structures where indicated in the Contract Documents,
  - o. Restoration in right-of-way and easements (not including curb and gutter restoration or pavement restoration, unless otherwise noted),
  - p. Stripping and stockpiling topsoil,
  - q. Temporary seeding and stabilization,
  - r. Temporary sheeting and bracing,
  - s. Temporary tie-ins of mains and laterals during installation, and
  - t. Testing.

#### **B. Sewer Laterals**

1. Measurement of the sewer laterals will be made along the centerline of the pipeline and based upon the linear footage or per each installed. Pipe will be measured from the service cleanout to the centerline of the gravity sewer pipe, manhole or mainline cleanout.
2. The cost of trench excavation and backfill for laterals shall be included in the unit price bid for each type of lateral, per foot or for each as indicated on the Bid form, regardless of the depth. Payment will include:
  - a. Bedding,

- b. Compaction,
- c. Dewatering,
- d. Disposal of surplus materials,
- e. Seeding and stabilization,
- f. Select materials,
- g. The cost of restoration in right-of-way, shoulders, and easements (not including curb and gutter restoration or pavement restoration, unless otherwise noted),
- h. Temporary sheeting and bracing,
- i. Testing, and
- j. Tracer wire.

### C. Manholes

#### 1. Standard Depth (0' to 6'):

- a. Measurement of manholes (4- or 5-foot diameter), will be made for each standard depth manhole (0' to 6') installed and satisfactorily tested as measured to the nearest foot from the bottom of the frame and cover to the invert out.
- b. Payment will be made at the unit price bid for each standard depth manhole installed and satisfactorily tested and will include the cost of the following:
  - i. All appurtenances required for satisfactory operation,
  - ii. Coatings (See III.H for Type B Coatings),
  - iii. Dewatering,
  - iv. Disposal of surplus material,
  - v. Excavation, bedding, backfill, and compaction,
  - vi. Invert shaping,
  - vii. Manhole, complete including benches, inverts and troughs, stainless steel insert, frame and cover, and riser (as required),
  - viii. Openings and seals,
  - ix. Precast concrete adjustment ring,
  - x. Restoration in right-of-way, shoulders, and easements (not including curb and gutter restoration or pavement restoration, unless otherwise noted)
  - xi. Seeding and stabilization,
  - xii. Sheetng and shoring,
  - xiii. Steps, unless otherwise noted,
  - xiv. Stone,
  - xv. Stripping and stockpiling of materials, and
  - xvi. Testing,

#### 2. Extra Depth:

- a. Measurement of manholes (4- or 5-foot diameter) in excess of 6-feet in depth will be made based on the vertical feet of manhole installed in excess of 6-feet, measured to the nearest foot from 6 feet below the bottom of the frame and cover to the invert out in depth and satisfactorily tested.

b. Payment will be made at the unit price bid for each additional vertical foot of manhole (in excess of 6' in depth) installed and satisfactorily tested and will include the cost of the following:

- i. All appurtenances required for satisfactory operation,
- ii. Backfill,
- iii. Bedding,
- iv. Compaction,
- v. Dewatering,
- vi. Disposal of surplus material.
- vii. Excavation,
- viii. Openings and seals,
- ix. Sheeting and shoring, and
- x. Steps, unless otherwise noted.

3. Drop Manhole (Inside or Outside), installed complete in place  
Payment will be made at the unit price bid for each type of drop manhole (with a drop either inside or outside the manhole), installed and satisfactorily tested and will include the cost of the following:

- a. All appurtenances required for satisfactory operation,
- b. Backfill,
- c. Bedding,
- d. Compaction,
- e. Dewatering,
- f. Disposal of surplus material
- g. Excavation,
- h. Inside or outside drop connection including drop pipe, fittings, attachments, and concrete,
- i. Manhole, complete including benches, inverts and troughs, stainless steel insert, frame and cover, and riser (as required), and
- j. Sheeting and shoring

4. Non-Standard Manholes

Measurement shall be made for non-standard, including polymer concrete manholes, measured from the interior base floor to the bottom of the frame. Payment shall be made for each manhole installed or per vertical feet as indicated on the Bid form. The cost shall include:

- a. All appurtenances required for satisfactory operation,
- b. Backfill,
- c. Bedding,
- d. Compaction,
- e. Dewatering,
- f. Disposal of surplus material,
- g. Excavation,
- h. Invert shaping
- i. Manhole, complete including benches, inverts and troughs, stainless steel insert, frame and cover, and riser (as required),
- j. Openings and seals,
- k. Precast concrete adjustment ring,

1. Restoration in right-of-way, shoulders, and easements (not including curb and gutter restoration or pavement restoration, unless otherwise noted),
- m. Seeding and stabilization,
- n. Sheeting and shoring,
- o. Steps, unless otherwise noted,
- p. Stone,
- q. Stripping and stockpiling of materials, and
- r. Testing.

5. Watertight Manhole Frame and Cover, installed complete in place

Watertight frame and cover assembly, to include dust cover and riser as required, shall be paid at the unit price bid for each.

**D. Clean-out and Main Line Clean-out Assemblies**

Payment will be made at the unit price bid for each clean-out assembly installed and satisfactorily tested and will include the cost of the following:

1. All appurtenances required for satisfactory operation,
2. Backfill,
3. Bedding,
4. Compaction,
5. Clean-out box with frame and cover,
6. Excavation,
7. Fittings,
8. Furnishing and installing the clean-out,
9. Stone,
10. Temporary seeding and stabilization,
11. Testing, and
12. Tracer wire and marking tape complete in place.

**E. Connections to existing manholes, complete in place.**

Connections to existing manholes will be paid for each connection installed and satisfactorily tested. Payment will include materials, excavation, backfilling, core drilling, dewatering, testing, repair of existing coating, rubber boot installation, and all other Work incidental to the connection to the existing manhole.

**F. Connections from new manholes to existing sanitary sewer, complete in place.**

Connections from new manholes to existing sanitary sewer will be paid for each connection installed and satisfactorily tested. Payment will include materials, excavation, backfilling, dewatering, testing, and all other Work incidental to the connection of adjacent, existing sanitary sewer to the proposed manhole.

**G. Payment for Manhole and Main Line Cleanout Adjustments Rings, for pavement overlay, shall be in accordance with Section 510.**

**H. Manhole/Structure Coatings**

1. Type B coating systems shall be measured on a vertical foot basis per manhole

diameter or per each structure.

2. Payment will be made based on the unit price bid per vertical foot for Type B coating system applied and the manhole diameter (4 foot or 5 foot), or per each structure as specified on the Bid form. Payment will include the costs associated with the following, plus all incidental items necessary for a complete and Owner approved coating system:
  - a. Applicator fees,
  - b. Clean up and disposal of surplus and excess materials,
  - c. Coating Materials,
  - d. Concrete surface preparation to the required CSP value, to include all environmental controls; containment, collection, and disposal of emissions and slurries; safety and protection; and restoration of affected areas,
  - e. Equipment necessary for the mixing and application of all coating materials,
  - f. Final cleaning of concrete surfaces,
  - g. Handling, storage and protection of all materials,
  - h. Safety equipment, and
  - i. Testing recommended by the coatings manufacturer and required by the Contract Documents

I. Payment for Sewage Bypass Pumping, if required, shall be considered incidental for flows under 2 MGD in accordance with Section 812 – Bypass Pumping.

End of Section