

**SECTION 02734**  
**INSPECTION AND TESTING OF**  
**SANITARY SEWER PIPELINES, MANHOLES, AND SERVICE LINES**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. This section covers the inspection and testing of pipelines, manholes, and service lines. Testing is required before final acceptance of pipelines and service lines by Little Rock Water Reclamation Authority (LRWRA).

**1.02 RELATED WORK**

- A. Section 02605 – Manholes
- B. Section 02610 - Pipe and Fittings
- C. Section 02730 - Sanitary Sewer Pipelines
- D. Section 02732 - Sanitary Sewer Service Lines
- E. Section 02766 - Cured-In-Place Pipe Installed Using the Inversion Method
- F. Section 02769 – Polyethylene Pipe Installed Using the Pipe Bursting Method
- G. Section 03700 - Manhole Rehabilitation

**1.03 SCOPE OF WORK**

All pipelines shall be inspected and tested before final acceptance. The methods to be used are as follows:

- A. New Gravity Sewer Pipelines
  - 1. Visual inspection during installation and before backfill.
  - 2. Low pressure air test.

3. Television inspection.
4. Mandrel test (Flexible pipes only) If Required by Little Rock Water Reclamation Authority.
5. Final Visual Inspection
6. Infiltration/exfiltration if Required by Little Rock Water Reclamation Authority.

#### B. Manholes

1. Visual inspection during installation and before backfill.
2. Vacuum testing.
3. Exfiltration test if required by Little Rock Water Reclamation Authority.
4. Final Visual Inspection.

#### C. Replacement Pipelines and Point Repairs

1. Visual inspection during installation and before backfill.
2. Low pressure air test.
3. Television inspection.
4. Mandrel test (Flexible pipes only) if required by Little Rock Water Reclamation Authority.
5. Final Visual Inspection.

#### D. Force Mains

1. Visual inspection during installation and before backfill.
2. Hydrostatic pressure test.

#### E. Service Lines

1. Visual inspection during installation and before backfill.
2. Soil Compaction testing of pipe bedding material before backfill.
3. Low pressure air test if required by Little Rock Water Reclamation Authority.
4. Exfiltration test if required by Little Rock Water Reclamation Authority.
5. Television inspection for pipe bursting existing service lines.

## **PART 2 - PRODUCTS**

**Not Used.**

## **PART 3 - EXECUTION**

### **3.01 VISUAL INSPECTION DURING INSTALLATION AND BEFORE BACKFILL**

- A. The Engineer of Record will inspect pipelines, manholes, and service lines during all phases of construction. The level of inspection is at the discretion of the Engineer of Record and will be based partly on the Contractor's ability, experience, and past performance. All work not conforming to these specifications that is discovered during this inspection phase will be corrected by the Contractor.

### **3.02 PRESSURE TEST FOR GRAVITY SEWER PIPELINES**

- A. The Contractor will perform pressure tests on all gravity sewer pipelines in the presence of the Engineer of Record.
- B. Lines will not be accepted until they pass all required tests.
- C. Perform the tests in the presence of the Engineer of Record's representative and/or Little Rock Water Reclamation Authority's representative. Provide Little Rock Water Reclamation Authority's representative at least 24 hours notice before beginning testing.
- D. The primary test method is the Low-Pressure Air Loss test for lines smaller than 24 inches in diameter. Under special conditions and when approved in advance by Little Rock Water Reclamation Authority the exfiltration/infiltration test procedure may be used.

### **3.03 LOW PRESSURE AIR LOSS PROCEDURE FOR GRAVITY SEWER PIPELINES**

- A. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- B. Pipe air supply to pipeline to be tested so that air supply may be shut off, pressure observed, and air pressure released from the pipe without entering the manhole. Install a valved branch in the supply line past the shut-off valve terminating in a 1/4" female pipe thread for installation of the test gauge.
- C. Add air slowly to portion of pipe under test until test gauge reads at least 4 psig, but less than 5 psig.

- D. Shut air supply valve and allow at least two minutes for internal pressure to stabilize.
- E. Determine time in seconds for pressure to fall 1 psig so that pressure at the end of time of the test is at least 2.5 psig.
- F. Compare observed time with minimum allowable times in the following chart for pass/fail determination.

**TEST CHART FOR AIR TESTING  
SEWERS**

Leakage Testing of Sewers by Low Pressure Air Loss  
(Time Pressure Drop Method)

Table 1 - Minimum Test Times in Seconds for 1 psig drop (3.5 psig to 2.5 psig)								
Distance Between Manholes	Nominal Pipe Diameter (inches)							
	6	8	10	12	15	18	21	24
100	40	70	110	155	245	350	480	625
150	60	105	165	235	365	500	595	680
200	80	140	220	315	425	510	595	680
250	100	176	270	340	425	510	595	680
300	120	215	283	340	425	510	595	680
350	140	226	283	340	425	510	595	680
400	160	226	283	340	425	510	595	680
450	170	226	283	340	425	510	595	680
500				340	425	510	595	680
550						510	595	680
600							595	680

NOTE: Due to force resisted by plug restraints, testing of sewers larger than 24" is not recommended.

- G. Where groundwater level is above the crown of the pipe being tested, increase test pressure at the rate of 1 psi for every 2.5 feet of water above the crown.
- H. Air Testing Safety Requirements:
  1. Securely brace plugs used to close the sewer pipe for the air test; this is to prevent the unintentional release of a plug which can become a high velocity projectile. For example: four pounds (gauge) air pressure develops a force against the plug in a 12" diameter pipe of approximately 450 pounds, this force can propel a 12-inch plug weighing 10 pounds to supersonic speeds.

2. Locate gauges, air piping manifolds, and valves at the top of the ground. Entry by anyone into a manhole where a plugged pipe is under pressure is strictly prohibited.
3. Do not use the air test on gravity sewer pipes larger than 24" in diameter because of the difficulty of adequately blocking the plugs.

**3.04 WATER LOSS TEST PROCEDURE (USE ONLY IF APPROVED IN ADVANCE BY LITTLE ROCK WATER RECLAMATION AUTHORITY UTILITY)**

- A. Perform the water test procedure to determine the quality of the sewer line against infiltration and exfiltration only when specifically approved by Little Rock Water Reclamation Authority. The Low-Pressure Air Loss Test outlined above is the standard test procedure. Where approved, follow the procedure below.
- B. Infiltration Test: Minimum test time is 2 hours. The allowable pipeline leakage rate under exterior ground water pressures is:
  1. For all pipe materials: 100 gallons (or less) per inch of nominal pipe diameter per mile of pipeline per 24 hours. Submit procedure to Engineer for approval if this test is used.
- C. Exfiltration Test: This test will be used if Little Rock Water Reclamation Authority decides the ground water table at the time of testing is too low to produce dependable results from the infiltration test. This test will not be used if Little Rock Water Reclamation Authority decides the ground water table is too high. The allowable pipeline leakage rates are the same as stated for the Infiltration Test. Submit procedure to Engineer for approval if this test is used.

**3.05 TELEVISION INSPECTION**

All newly installed sewer mains shall be televised as follows:

- A. The Contractor shall clean all lines thoroughly prior to the start of televising.
- B. Each segment of pipe shall be televised.
- C. The sewer main shall be televised to reveal possible defects in material or workmanship.

- D. The Contractor shall correct any defects discovered during the television inspection at the Contractor's expense.
- E. Any televising of line segments by the Contractor will be made in the presence of the representative of the Engineer of Record and final videos shall be delivered to Little Rock Water Reclamation Authority for review and approval. Little Rock Water Reclamation Authority's representative will be notified in advance of all televising of line segments performed by the Contractor.

### **3.06 MANDREL TEST (FLEXIBLE PIPE ONLY)**

- A. The maximum allowable pipe deflection is five (5) percent of the inside pipe diameter.
- B. Any sewer pipe which fails the mandrel test prior to final acceptance will not be accepted by LRWRA until the defects are corrected.
- C. All mandrel tests shall be performed by the Contractor while observed by the Engineer of Record's representative.

### **3.07 SUPPLEMENTAL MANDREL TESTING**

- A. LRWRA may at any time after final acceptance perform supplemental mandrel testing on pipelines constructed of flexible pipe material. These supplemental tests will be performed as detailed above with a maximum allowable long-term deflection of five percent (5%).
- B. Any sewer pipe which fails a mandrel test prior to expiration of the maintenance bond will be corrected by the Contractor at the Contractor's expense. If the Contractor fails to correct these defects within sixty (60) days of notification of failure, then LRWRA will correct the defects and file a claim with the bonding company.

### **3.08 FINAL VISUAL INSPECTION**

- A. Upon completion of the above tests the Engineer of Record will perform a final visual inspection of pipelines and manholes.
- B. A punch list of defects (including obvious running leaks) will be prepared and sent to the Contractor for correction at the Contractors' expense.

### 3.09 INSPECTION FOR SERVICE LINES

- A. All building sewer installations shall be inspected and approved by an authorized LRWRA inspector.
- B. Backfill may only be placed on the completed portions of a building sewer following inspection. No approval certificate shall be issued until all portions of a building sewer from the main connection to the building foundation have been inspected and approved by an authorized inspector. At the time of inspection, the pipe should be in place in the trench and "safed-up", but the top half of the pipe barrel exposed. No approval will be given for building sewers all or a portion of which are covered at the time of inspection.
- C. All building sewers are subject to testing to ensure water tightness and integrity of pipe and bedding. All tests must be performed in the presence of a representative of Little Rock Water Reclamation Authority. Tests may consist of:
  - 1. Water Loss Test Procedure,
  - 2. Low Pressure Air Loss Procedure, or
  - 3. Soil Compaction Testing
- D. Water Loss Test Procedure
  - 1. Plug the section of line to be tested at the lower end and fill section with water so that at least four (4) feet of head is obtained.
  - 2. The maximum acceptable water loss while so filled is not more than 100 gallons per twenty-four hours per inch of pipe diameter per mile of pipe. This equates to approximately 3/16 gallon for a one hundred (100) foot long section of four (4) inch pipe tested for thirty minutes.
- E. Low Pressure Air Loss Procedure
  - 1. Plug securely both ends of the line to be tested.
  - 2. Charge the line with air to a pressure of 4.5 psig.
  - 3. Allow at least five minutes for the temperature in the pipe to stabilize.
  - 4. Measure the time required for a one (1.0) psi drop in pressure.
  - 5. The minimum time for a one psi loss is  $28.5 \times d$  seconds where  $d$  = the nominal diameter in inches of the pipe being tested.

## F. Soil Compaction Testing

1. Observe trench laying conditions and native material excavated from trench.
  - a. If native material contains organic material, topsoil, or otherwise deleterious material, then it may not be used for pipe bedding or trench backfill.
  - b. If native material is deemed suitable in accordance with Part 3.09.F.1.a, above, and if it furthermore contains no rocks or stones larger than 2" in greatest dimension, then it may be used under some conditions as pipe embedment, as described in Section 02220 of these Standard Specifications.
2. LRWRA Inspector shall determine the compaction of the pipe embedment material after the Contractor (or Plumber) has installed and compacted this material up to the springline of the pipe, leaving the top of the pipe exposed.
  - a. This determination shall be made via first observing the penetrability of the material in place. If in the sole judgement of the LRWRA Inspector the embedment material is compacted to approximately 75% standard proctor or greater compaction, then the LRWRA Inspector may at his or her discretion allow the pipe embedment and trench backfill to proceed to completion.
  - b. If the LRWRA Inspector judges necessary, then further testing of the soil compaction may be required prior to proceeding with pipe embedment or trench backfill. Such additional testing may consist of mechanical means, nuclear density testing, or other empirical method(s) for determining soil compaction in accordance with applicable LRWRA, ArDOT, or other standards.

### **3.10 PRESSURE TEST FOR FORCE MAINS**

- A. Perform hydrostatic leakage tests for force mains by filling the force main with water and increasing the pressure to a testing pressure of 150% of the working pressure with a minimum of 100 psi.
- B. The duration of the leakage test shall be two hours or as specified by the Engineer of Record.
- C. The force main will not be accepted until the actual leakage is equal to or less than the allowable. In addition, all obvious leaks shall be repaired.

- D. The allowable leakage rate per hour for ductile iron, PVC, or concrete pipe shall be calculated by the following formula:

$$L = \frac{ND \times P^5}{7400}$$

Where:        L = Allowable Leakage (gallons per hour)  
                  N = Number of Joints in Pipeline Tested  
                  D = Nominal Diameter (inches)  
                  P = Test Pressure (psi)

### **3.11 MANHOLE TESTING**

- A. The Contractor shall vacuum test all new manholes constructed.
- B. The Contractor shall vacuum test all manholes that have been sealed (waterproofed).
- C. The Contractor shall vacuum test all manholes that have been epoxy lined.
- D. Manholes shall be tested in accordance with ASTM C 1244-93. Vacuum test shall not be performed earlier than 7 days after construction or installation. The Contractor shall provide all testing equipment, pump, hosing, seal, and other incidentals. Vacuum test head shall be positioned at the top of the casting (the surface on which the manhole cover rests, to include grade rings) in accordance with the equipment manufacturer's instructions. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump isolated by the shut-off valve on the test head connection. When the valve is closed, time measurement shall commence. The time required for vacuum drop to 9-inches of mercury shall be observed and recorded. Manholes shall pass if the time for the vacuum reading to drop from 10-inches of mercury to 9-inches of mercury meets or exceeds the time values in seconds in Table 2 on the following page.

Table 2 - Minimum Test Times for Various Manhole Diameters (seconds)									
Depth (feet)	Diameter								
	30	33	36	42	48	54	60	66	72
<10	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	57	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	70	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

- E. Manholes showing greater than the allowable leakage shall be repaired and re-tested until a satisfactory leakage result is obtained.
- F. The Engineer of Record will be required to certify that all manholes on a project have been vacuum tested and have passed the test criteria. Copies of the test results will be supplied to Little Rock Water Reclamation Authority if requested.

**END OF SECTION 02734**