

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 Wastewater.

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 Wastewater
 5. Final Visual Inspection
 6. Infiltration/exfiltration if Required by Little Rock Wastewater.
- B. Manholes
1. Visual inspection during installation and before backfill.
 2. Vacuum testing.
 3. Exfiltration test if required by Little Rock Wastewater.
 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 Wastewater
 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. Low pressure air test if required by Little Rock Wastewater.
 3. Exfiltration test if required by Little Rock Wastewater.
 4. 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 Contractors 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. Provide Little Rock Wastewater'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 Wastewater 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 WASTEWATER 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 Wastewater. 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 Wastewater 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 Wastewater 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 the Little Rock Wastewater for review and approval. Little Rock Wastewater'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 LRW 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. LRW 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 the 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 after a reasonable time, the Utility 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 LRW 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 insure water tightness. All tests must be performed in the presence of a representative of Little Rock Wastewater. Tests may be either by:
 - 1. Water Loss Test Procedure; or,
 - 2. Low Pressure Air Loss Procedure.
- D. If, in the opinion of the Little Rock Wastewater, the line in question is properly installed and free from open joints and breaks, building sewers constructed entirely of cast iron soil pipe may be connected to the city sewer without testing.
- E. 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 is approximately 3/16 gallon for a one hundred (100) foot long section of four (4) inch pipe tested thirty minutes.
- F. 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.

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:

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

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 valve is closed, time measurement shall commence, and 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 the following table.

Table 1 - Minimum Test Times for Various Manhole Diameters (seconds)									
Depth (feet)	Diameter (inches)								
	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 Little Rock Wastewater if requested.

END OF SECTION 02734