

SECTION 33 05 05.33

Infiltration and Exfiltration Testing

PART 1: GENERAL

1.1 SCOPE OF WORK

- A. Test all piping, valves, manholes and appurtenances installed under this Contract. Testing shall be performed concurrent with installation. Do not install more than 1,000 feet of pipe without being tested, unless approved by Owner.

1.2 SUBMITTALS

- A. Prepare and submit schedules and procedures to Owner for testing of all parts of the sewer main installed in accordance with this Contract. Submit the schedule at least seven days prior to any testing.

PART 2: PRODUCTS

2.1 EQUIPMENT

- A. Furnish the pump, pipe connections, regulator to avoid overpressurization, and all necessary apparatus for the pressure and leakage tests including gauges and metering devices. Owner reserves the option to furnish the gauges and metering devices for the tests. Excavate, backfill, and furnish all necessary assistance for conducting the tests.

PART 3 EXECUTION

3.1 GENERAL

- A. Air Testing of Gravity Systems: All sewers shall be tested for excessive leakage.
 - 1 Contractor may perform air tests for all pipe (except concrete and fiberglass) for all sizes.
 - 2 The air test, if used, shall be conducted in accordance with one of the following Standards:
 - a. ASTM C1103-14 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
 - b. ASTM F1417, "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air." For plastic, composite and ductile Iron Pipe.

- c. UNI-B-6, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe." Published by the Uni-Bell PVC Pipe Association. The testing method selected shall properly consider the existing groundwater elevations during the test. If the test section fails the test for excessive leakage, the contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner and re-test
- 3 The pipe plug for introducing air to the sewer line shall be equipped with two taps. One tap will be used to introduce air into the line being tested through suitable valves and fittings, so that the input air may be regulated. The second tap will be fitted with valves and fittings to accept a pressure test gauge indicating internal pressure in the sewer pipe. Additional valve and fitting will be incorporated on the tap used to check internal pressure so that a second test gauge may be attached to the internal pressure tap. The pressure test gauge will also be used to indicate loss of air pressure due to leaks in the sewer line.
- 4 The pressure test gauge shall meet the following minimum specifications:
- | | |
|--------------------|--|
| Size (diameter) | 4.5 inches |
| Pressure Range | 0 -15 psi |
| Figure Intervals | 1 psi increments |
| Minor Subdivisions | 0.05 psi |
| Pressure Tube | Bourdon Tube or diaphragm |
| Accuracy | ± 0.25% of maximum scale reading |
| Dial | White coated aluminum with black lettering, 270° arc and mirror edge |
| Pipe Connection | Low male 1/2 inch N.P.T. |
- Calibration data will be supplied with all pressure test gauges. Certification of pressure test gauge will be required from the gauge manufacturer. This certification and calibration data will be available to the Engineer whenever air tests are performed.
- Gravity sewer pipe shall be air-tested in accordance with the requirements of ASTM F 1417.
- 5 Plug ends of line and cap or plug all connections to withstand internal pressure. One of the plugs provided must have two taps for connecting equipment. After connecting air control equipment to the air hose, monitor air pressure so that internal pressure does not exceed 5.0 psig. After reaching 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two (2) minutes in order to allow equilibrium between air temperature and pipe walls. During this time, check all plugs to detect any leakage. If plugs are found to leak, bleed off air, tighten plugs, and again begin supplying air. After temperature has stabilized, the pressure is allowed to decrease to 3.5 psig. At 3.5 psig, begin timing to determine the time required for pressure to drop to 2.5 psig. If the time in seconds for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe shall be presumed free of defects.

Pipe Diameter (in)	Minimum Time	Length	Minimum Time for Longer Length (sec) L = Total Length
4	3:46	597	0.380 * L
6	5:40	398	0.854 * L
8	7:34	298	1.520 * L
10	9:26	239	2.374 * L
12	11:20	199	3.418 * L
15	14:10	159	5.342 * L
18	17:00	133	7.692 * L
21	19:50	114	10.470 * L
24	22:40	99	13.674 * L
27	25:30	88	17.306 * L
30	28:20	80	21.366 * L
33	31:10	72	25.852 * L
36	34:00	66	30.768 * L
42	39:48	57	41.883 * L
48	45:34	50	54.705 * L

If air test fails to meet above requirements, repeat test as necessary after all leaks and defects have been repaired and backfilled. Prior to acceptance, all constructed sewer lines shall satisfactorily pass the low pressure air test.

- 6 If the maintenance of existing flow in a pipe is necessary and air pressure testing is not possible, the Contractor shall perform closed circuit television inspection of the pipe at the Contractor's expense.

B. DEFLECTION: Not less than 30 days after completion of the backfill, a deflection test shall be performed for all flexible and semi-rigid pipes. If any section fails the test for excessive deflection, the contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner and re-test. Deflection tests shall be conducted using a go/no-go mandrel of at least nine (9) or more odd number fins. The mandrel's outside dimension shall be sized to permit no more than 5 percent deflection. The percent deflection shall be established from the base inside diameter of the pipe. The mandrel shall be approved by the Owner prior to use. Lines that permit safe entry may allow other deflection test options, such as direct measurements with extension rulers.

C. Should any test disclose damaged or defective materials or leakage greater than that permitted, the Contractor shall, at the Contractor's expense, locate and repair and/or replace the damaged or defective materials. Materials used for repair must be approved by Owner and meet the relevant specifications. Repeat the tests until the leakage is within the permitted allowance and is satisfactory to MAWC.

D. MANHOLES – Contractor shall furnish all labor and materials for the testing of all manholes and structures.

- 1 All manholes shall be tested after backfilling to at least the level of the bottom adjustment ring.
- 2 The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab or top adjustment ring

- 3 All pipes entering the manhole shall be plugged at least eight (8) inches into the sewer pipe. The plug must be inflated at a location beyond the manhole/pipe gasket and shall be adequately braced to prevent the plug of pipe from being dislodged and pulled into the manhole
- 4 A vacuum of at least 10.5 inches of mercury shall be drawn on the manhole. Shut the valve on the vacuum line to the manhole and disconnect the vacuum line. Open the vacuum line valve and adjust the vacuum to ten (10) inches of mercury.
- 5 A liquid filled pressure gage shall be used with a reading from zero (0) to thirty (30) inches of mercury
- 6 The time for the vacuum reading to drop from ten (10) inches of mercury to nine (9) inches of mercury must be equal to or greater than the following values for the manhole to be considered as passing the test.
 - a.

Manhole Depth	Time (minutes)
10 feet or less	2
10.1 to 15 feet	2.5
15.1 to 25 feet	3

- 7 If a manhole fails the vacuum test, the manhole shall be uncovered and the leak repaired by patching the exterior of the manhole. The manhole shall then be backfilled and re-tested
- 8 The vacuum testing of the manholes shall be done prior to air testing the sewer lines that enter or exit the manhole.

END OF SECTION 33 01 10.13