

SECTION 02651

SANITARY SEWER TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this section includes, but is not limited to:

1. Testing Gravity Sewer Pipelines:

- a. Lamping
- b. Low-pressure air test
- c. Infiltration test

2. Testing Pressure Pipelines:

- a. Hydrostatic leakage test
- b. Deflection (PVC only)

3. Testing Manholes:

- a. Vacuum test

B. Related work specified elsewhere:

- |  |               |
|--|---------------|
| 1. Manholes:                             | Section 02601 |
| 2. Sanitary Sewer Pipe:                  | Section 02610 |
| 3. Testing and Disinfecting Water Mains: | Section 02653 |

C. Definitions:

NONE

D. Applicable Standard Details:

NONE

1.02 QUALITY ASSURANCE

A. Test Acceptance:

- 1. No test will be accepted until the results are within the specified limits.
- 2. The Contractor shall, at his own expense, determine and correct the causes of test failure and retest until successful test results are achieved.

1.03 SUBMITTALS

- A. Testing procedures
- B. List of test equipment
- C. Testing sequence schedule
  
- D. Provisions for disposal of flushing and test water
- E. Certificate of test gauge calibration

1.04 JOB CONDITIONS:

- A. The Municipality will witness all tests. A minimum of 48 hours notice is required to schedule Municipality personnel.
- B. Do not allow personnel in manholes during pressure and vacuum testing.
- C. Provide relief valves set at 10 psig to avoid accidentally over-pressurizing gravity sewer line during low pressure air testing.

PART 2 - PRODUCTS

2.01 AIR TEST EQUIPMENT

- Air compressor
- Air supply line
- Shut-off valve
- Pressure regulator
- Pressure relief valve
- Stop watch
- Plugs
- Pressure gauge, calibrated to 0.1 lbs./sq. in.

2.02 DEFLECTION TEST EQUIPMENT

- Go, No-Go mandrels - furnished by Municipality
- Pull/retrieval ropes

2.03 VACUUM TEST EQUIPMENT

- Vacuum pump
- Pipe plugs
- Vacuum hose
- Test connections
- Vacuum gauge
- Vacuum relief valve

2.04 NON-SHRINK GROUT

- Fastsetting, cement based mortar such as Waterplug, manufactured by Thoro Division of ChemRex, Shakopee, MN, or approved equal.

2.05 INFILTRATION TEST EQUIPMENT

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PART 3 - EXECUTION

3.01 PREPARATION

- A. Backfill trenches in accordance with Section 02221.
- B. Provide pressure pipeline with concrete reaction support blocking.
- C. Clean and flush pipeline with water to remove debris. Collect and dispose of flushing water and debris in accordance with Federal, State and local regulations.
- D. Plug outlets, wye-branches and laterals. Brace plugs to offset thrust.

3.02 TESTING GRAVITY SEWER PIPELINES

- A. Lamping:
  - 1. After flushing and cleaning, lamp gravity pipeline in conjunction with the Authority.
  - 2. Assist the Authority in the lamping operation by shining a light at one end of each pipeline section between manholes. Pipeline that has not been installed with uniform line and grade will be rejected. Remove and re-lay rejected pipeline sections. Re-clean and lamp until pipeline section achieves a uniform line and grade.
- B. Low Pressure Air Test, gravity mains:
  - 1. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
  - 2. If the pipe to be tested is submerged in ground water, insert a pipe probe by boring or jetting, into the backfill material adjacent to the center of the pipe, and determine the pressure in the probe when air passes slowly through it. This is the back pressure due to ground water submergence over the end of the probe. All gauge pressures in the test should be increased by this amount.
  - 3. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.
  - 4. After an internal pressure of 4.0 psig is obtained, allow at least two (2) minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
  - 5. When pressure decreases to 3.5 psig, start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding times are indicated in the Air Test Table.

6. The air test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an eight (8") inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
7. As a safety precaution, pressurizing equipment should include a regulator set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.
8. Pipe sections which do not pass the above specified test shall be tested after checking all capped and plugged fittings with a soap solution or the introduction of smoke into the pipe to detect points of leakage and such repairs must be made, as required, to obtain acceptance of each pipe section.

AIR TEST TABLE

MINIMUM HOLDING TIME IN SECONDS REQUIRED FOR PRESSURE TO DROP  
FROM 3.5 PSIG TO 2.5 PSIG

Length (ft)	Pipe Diameter				
	4"	6"	8"	10"	12"
25	4	10	18	29	40
50	9	20	35	35	79
75	13	30	53	83	119
100	18	40	70	110	158
125	22	50	88	138	198
150	26	59	106	165	236
175	31	69	123	193	277
200	35	79	141	220	317
225	40	89	158	248	340
250	44	99	176	275	340
275	48	109	194	283	340
300	53	119	211	283	340
350	62	139	227	283	340
400	70	158	227	283	340
450	79	170	227	283	340
500	88	170	227	283	340
550	97	170	227	283	340
600	106	170	227	283	340
650	113	170	227	283	340

C. Testing Pipe Over 36" Diameter:

1. Pipe over 36" diameter shall be subjected to a visual interior inspection.

D. Infiltration Test:

1. Use only when leakage is visible and as directed by the Municipality.
2. Maximum Allowable Infiltration: 200-gallons per inch of pipe diameter per mile of pipe per 24 hours.

E. Deflection Testing of Plastic Sewer Pipe:

1. Perform vertical ring deflection testing on all portions of PVC sewer piping, in the presence of the Municipality, after backfilling.

2. The maximum allowable deflection for installed plastic sewer pipe shall be limited to 5% of the original vertical internal diameter.
3. Perform deflection testing with a properly sized 'Go, No-Go' mandrel provided by Municipality.
4. Pipe exceeding the allowable deflection shall be located, excavated, replaced, and retested at the sole expense of the Contractor, including surface restoration.
5. During the 12th month of the warranty period, perform a second vertical ring deflection test on all portions of PVC sewer piping, in the presence of the Municipality, including preparation in accordance with Article 3.01C.

### 3.03 TESTING PRESSURE PIPELINES

A. For PVC force mains, perform hydrostatic leakage test as follows:

1. Test each newly laid pressure pipeline, including any valved section thereof, hydrostatically at 1.5 times the working pressure of the pipeline based on the elevation of the lowest point in the pipeline corrected to the elevation of the test gauge. Obtain test pressure from the Engineer.
2. Slowly fill the section to be tested with water, expelling air from the pipeline at the high points. Install corporation stops at high points if necessary. After all air is expelled, close air vents and corporation stops and raise the pressure to the specified test pressure.
3. Observe joints, fittings, and valves under test. Remove and replace cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
4. After visible deficiencies are corrected, continue testing at the same test pressure for an additional two hours to determine the leakage rate. Maintain pressure within plus or minus 5.0 psi of test pressure. Leakage is defined as the quantity of water supplied to the pipeline necessary to maintain test pressure during the period of the test.
5. Compute the maximum allowable leakage by the following formula:

$$L = \frac{ND(P)^{0.5}}{7,400}$$

Where: L is the allowable leakage in gallons/hour  
 N is the number of joints in the section tested  
 D is the nominal diameter of the pipe in inches  
 P is the average test pressure in psig

If the line under test contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size.

6. If the test of the pipe indicated leakage is greater than that allowed, locate the source of the leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of the amount of leakage.

B. For Ductile Iron Force Main. After ductile iron force mains have been laid and partially backfilled, but prior to covering the joints, the pipe shall be subjected to a hydrostatic test of fifty (50) psi in excess of what the maximum static pressure will be when the force main is in operation. After the Municipality has inspected and approved all joints at this pressure, the test may be stopped and backfilling commenced, as hereinafter specified. The Contractor shall furnish all labor, equipment, water, and materials necessary for this test.

### 3.04 TESTING MANHOLES

A. Test all new manholes for exfiltration utilizing the vacuum test method and equipment developed by NPC Systems, Inc., Milford, NH, or approved equal.

B. The Contractor shall provide the necessary labor, equipment or materials to conduct the vacuum test.

C. The testing shall be done after complete assembly of the manhole.

D. The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe.

E. With the vacuum tester set in place:

1. Inflate the compression band to effect a seal between the vacuum base and the structure.

2. Connect the vacuum pump to the outlet port with the valve open.

3. Draw a vacuum to 10" of Hg. and close the valve.

- F. A vacuum of 9 in. of Hg. or more shall be maintained for at least the period of time indicated in the following table in order to successfully complete the test:

Depth of Manhole (Feet)	Diameter of Manhole (Inches) Time (Seconds)		
	48 Inches	60 Inches	72 Inches
up to 10	30	30	30
12	30	30	34
14	30	32	40
16	30	37	45
18	32	41	51
20	35	46	57
22	39	51	62
24	42	55	68
26	46	60	74
28	49	64	80
30	53	69	85

- G. If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs. Leaks and lift holes shall be filled with approved non-shrink grout.

END OF SECTION