PART ONE - GENERAL

1.1 Description Of Work - The work to be performed under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to test sanitary sewer gravity and pressure (force) mains as specified herein.

PART TWO - PRODUCTS

2.1 N/A

PART THREE - EXECUTION

3.1 TESTING OF GRAVITY SANITARY SEWER

3.1.1 General - The Contractor shall use a low-pressure air test and a deflection mandrel test. The Contractor shall furnish all facilities and personnel for conducting all testing.

3.1.2 Cleaning And Flushing - Prior to pipe testing, all pipe shall be thoroughly cleaned to the satisfaction of the Engineer in the following manner: The Contractor shall furnish an inflatable ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tab line, or a rope or cord may be fastened to the ball to enable the Contractor to know and control the ball's position at all times.. The ball shall be placed in the last cleanout or manhole on the pipe run to be cleaned and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or wedged debris or damaged pipe shall stop the ball, the Contractor shall remove the obstruction and resume cleaning.

3.1.2 Low Pressure Air Test - The following procedures shall be used in conducting the low-pressure air test:

All wyes, tees or end of sewer stubs shall be plugged with flexible joint caps or acceptable alternate, securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension. No double plugs shall be allowed. Immediately following the pipe cleaning, the pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any

ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization before proceeding further.

For sections of pipe less than 36 inch average diameter, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed from the following equation:

$$T = 0.0850 \frac{DK}{Q}$$

Where: T = time in seconds for air pressure to drop 1.0 psig
K = 0.000419 (D)(L), but not less than 1.0
D = nominal pipe diameter in inches
L = length of pipe being tested in feet
Q = rate of loss; assume 0.0015 cubic feet/min. per sq. ft internal surface

Since a K value of less than shall not be used, the minimum testing times for each pipe diameter is shown below:

Pipe Diameter (inches)	Minimum Time (seconds)	Length For Min. Time (feet)	Time For Longer Length (seconds)
4	227	597	0.380 (L)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

The use of air pressure for testing sewer lines creates hazards that must be recognized. The Contractor shall be certain that all plugs are securely blocked to prevent blowouts. A supply air regulator shall be installed on the air supply line to the sewer that shall permit a maximum of 10 psi in the line to be tested. All pressure shall be relieved from the sewer section being tested prior to removal of test plugs. No one shall be allowed in the manholes during testing.

3.1.3 Deflection Mandrel Test - No sooner than 30 days, nor later than 12 months (TNRCC requirements) after the pipe has been installed, all such pipe shall be tested for deflection with a "GO, NO-GO" Deflection Testing Mandrel. Unless

specified otherwise, the ***maximum allowable pipe deflection*** for PVC/Flexible pipe ***shall be 5%.***

All locations with excessive deflection shall be excavated, and repaired by rebedding or replacement of the pipe. For purpose of deflection measurements the required deflection mandrel dimensions are shown in the attached Uni-Bell PVC Pipe Association Drawing No. UNI-TR-1-90. "O, D C and L" dimensions are shown below for 5% deflection:

Nominal Pipe Size (in.)	Base Inside Diameter (in.)	O.D. of 5% Deflection Mandrel (in.)	"C" for 5% Deflection Mandrel (in.)	Max. "L" Req'd for 5% Mandrel (in.)
6	5.742	5.51	4.51	6
8	7.665	7.35	6.35	8
10	9.563	9.17	8.17	10
12	11.361	10.90	9.90	12
15	13.898	13.33	12.33	15
18	16.976	16.28	15.28	18
21	20.004	19.18	18.18	21
24	22.480	21.56	20.56	24
27	25.327	24.29	23.29	27

3.2 TESTING OF SANITARY SEWER PRESSURE (FORCE) MAIN

The force main shall be tested over its entire length to one and one-half (1 ½) times the maximum design pressure. The test procedure shall be as follows:

1. A pressure gauge shall be installed within 10 feet of the pump.
2. The lift station shall be supplied with sewage and/or potable water sufficient to cause discharge at the end of the force main.

3. After the force main is full of liquid and free of air and during a period when all lift station pumps are in operation, the pressure on the test gauge shall be read and recorded.

4. The open end of the force main shall be sealed and with an exterior test pump (not the lift station pumps), the pressure on the gauge shall be brought to one and one-half (1 ½) times the maximum design and held for one hour. Pressure loss shall not exceed 5% of the maximum test pressure.

5. The seal, external pump and pressure gauge shall be removed and all holes or connections pertaining to them shall be sealed permanently, to the satisfaction of the Engineer.

PART FOUR - MEASUREMENT AND PAYMENT

4.1 The cost of the work described in this specification shall not be paid for separately, but shall be considered subsidiary to the cost of pipe installation and related work.