SECTION 02660

PIPELINE TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing requirements for potable and non-potable water piping systems and sanitary sewers.

1.02 DEFINITIONS

A. Leakage: The quantity of water required to maintain the specified hydrostatic test pressure after the pipeline has been filled with water and the air expelled.

B. Non-rigid Pipe: Any pipe which required bedding and backfill material for structural support.

1.03 SUBMITTALS

A. Pipeline Test Report: Include the following items:

1. Type of test.

2. Identification of pipe system.

3. Size, type, location and length of pipe in test section.

4. Test pressure and time.

5. Amount of leakage versus allowable.

6. Date of test approval.

7. Signature of test supervisor.

8. Signature of the City Engineer, Inspector, or City Water Superintendent witnessing and approving the test.

9. One copy of video tape.

1.04 PROJECT CONDITIONS

A. After construction of sanitary sewer lines, they shall be thoroughly cleaned and test for leakage and alignment in the presence of the City Engineer or the City Inspector before acceptance by the City.

B. Repair pipeline system at no additional cost to City until it passes subsequent retesting.

C. Recording Equipment:

1. Supply all necessary equipment to perform pressure testing.

2. Secure City’s approval of pressure gages.

3. Locate all gages and recording equipment away from affects of sunshine or other weather conditions.

4. Place, vents, pressure taps and drains for the test. Repair pipeline at the completion of the test at no cost to City.

PART 2 PRODUCTS

2.01 TESTING MATERIALS

A. Medium: Water or air, as required by test.

B. Equipment: Temporary motors, pumps, pumping apparatus, pressure gages, connections, power, etc. for making the tests.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify City Engineer or City Water Superintendent 48 hours in advance of test.

B. Carry out tests as pipeline construction progresses to ensure construction methods are producing satisfactory results.

C. Disinfect potable water pipelines per section 2675 prior to pressure testing if connected to an existing system.

3.02 PRESSURE TESTING FOR PRESSURIZED WATER PIPELINES

A. Expel all air from the pipeline before applying the specified test pressure. Provide air release taps at points of highest elevations before testing. Insert permanent plugs after test has been completed.

B. A minimum pressure 50 psi in excess of the designated class rating of the pipe being tested shall be maintained on the portion being tested for a minimum period of two hours, using hydraulic means to maintain the pressure.

C. Maximum leakage during the test shall not exceed one-half (½) gallon per inch of diameter per 1000 feet of pipe.

D. Provide suitable means for determining water lost by leakage under the test pressure.

E. Locate and repair the defective joints and retest until the leakage is within the specified allowance.

F. Repair any noticeable leakage even if total leakage is less than allowable.

G. Flushing:

1. After pressure testing all pipelines shall be flushed.

2. Flushing shall be accomplished through hydrants or, if a hydrant does not exist at the end of the line, the Contractor shall install a tap of sufficient size to provide for a 2.5 foot per second flushing velocity in the line.

3. The following flow quantity required to provide a 2.5 foot per second flushing velocity:

PIPE SIZE (In.)	FLOW (gpm)
4	100
6	220
8	390
10	610
12	880
16	1567

H. Service Lines:

1. Potable water service lines may be connected to a potable water line after disinfection and bacteriological testing of the line is completed in accordance with Section 2675 Part 3.06. If service lines are connected before disinfection of water line, each service line must be flushed in accordance with Section 2675 Part 3.06.

2. All service lines shall be pressure tested up to the curb stop in accordance with this section.

3. The connection between the water meter box and curb stop shall be either pressure tested in accordance with the guidelines in this section or visually inspected for leaks once the working water pressure is turned into the service line.

3.03 ALIGNMENT AND GRADE TEST

A. No variance will be allowed from line and grade in excess of 1/32" per inch of pipe diameter or ½" maximum provided that such variation shall not result in a level or reverse sloping invert.

B. Variations in invert elevations between adjoining ends of pipe due to eccentricity of joining surface and pipe interior surface shall not exceed 1/64" per inch of pipe diameter, or ½" maximum.

3.04 OBSTRUCTION TEST

A. Visually examine pipe internally for obstructions by use high power light or mirror.

B. When required by the City Engineer, a round incompressible mandrel 1" less in diameter than the internal pipeline diameter and 2 times the diameter in length will be passed through the pipeline.

3.05 NON-RIGID PIPE DEFLECTION TEST

A. When required by the City Engineer, test installed sections of non-rigid pipeline to ensure that circumferential deflection does not exceed 5 percent of the average inside diameter using a rigid mandrel with a circular cross section pulled through the pipe by hand.

3.06 INFILTRATION TEST

A. No pipe section will be accepted if the infiltration rate exceeds 100 gallons per inch diameter per mile per 24 hours.

3.07 FLUSHING OF SANITARY SEWERS

A. All sanitary sewer lines shall be flushed and cleared prior to acceptance by the City.

B. Flushing:

1. Laterals and trunk lines shall be flushed by water with a high pressure sewer jet to remove all foreign material. Flushing shall be completed prior to television inspection.
2. All debris located at the bottom of each manhole shall be removed. Dirt grease, sand, and gravel shall be removed so that the walls of the sewer pipe can be inspected.

3. Wastewater and debris shall not be permitted to enter sewer lines in service, but shall be removed at the lowest manhole of the extension.

4. Other methods of cleaning may be used upon approval of the City Engineer.

5. After the lines have been thoroughly cleaned, they shall be tested between all manholes for displacement.

3.08 LEAKAGE TESTS FOR SANITARY SEWERS

A. General Requirements:

1. The contractor shall test all sanitary sewers by means of an exfiltration test.

2. Length of line tested at one time shall be limited to the length between adjacent manholes.

B. Testing with Water:

1. Each section of the sewer shall be tested between successive manholes by closing the lower end of the sewer to be tested and the inlet of the upper manhole with stoppers.

2. The pipe and manhole shall be filled with water to a point approximately 4-feet above the invert of the sewer at the center of the upper manhole.

3. The allowable leakage will be computed by the formula:

$$E = 0.25\ D\ H$$

Where: E = Allowable leakage in gallons per minute per 1000 feet of sewer tested.
D = Internal diameter of the pipe in inches.
H = Difference in elevation in the water surface in the upper manhole and the invert of the pipe at the lower manhole (feet).

4. Leakage from the sewer, as shown by the test, which exceeds that allowed by the formula will be corrected by the Contractor to reduce the exfiltration to within permissible limits.

5. Where the difference in elevation between inverts of adjacent manholes exceeds 10-feet, the exfiltration leakage test will be modified as directed by the City Engineer.

6. House surface laterals shall be considered part of the main sewer to which they are connected and shall be tested with the main line sewer.

C. Testing with air:

1. Air pressure may be used in lieu of the water exfiltration test subject to the approval of the City Engineer.

2. The low pressure air test shall be conducted by the following method under the direction of the City Engineer or City Inspector with equipment equal to Cherne Industrial, Inc.

3. All wyes, tees, or ends of lateral stubs shall be suitably capped and braced to withstand the internal test pressures. Caps shall be easily removable for future lateral extensions.

4. After a manhole to manhole section of line has been backfilled and cleaned, it shall be plugged at each manhole with pneumatic plugs. One of the plugs shall have three hose connections. Air for inflation of the triple connection pneumatic plug shall be supplied through a factory-equipped control panel. There shall be three hose connections from the control panel to the pneumatic plug. One hose shall be used for inflation of the plug. The second hose shall be used for continuously reading the air pressure in the sealed line. The third hose shall be used for introducing low pressure air into the sealed line.

5. There shall be a 3-1/2" or larger diameter, 0.30 psig gauge mounted on the control panel for reading of the internal pressure in the line being tested. Calibrations from the 0-10 psig range shall be in tenths of pounds and the 0-10 psig portion shall cover 90% of the complete dial range.

6. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe.

7. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (3.5 psig minimum pressure in the pipe), the third hose shall be disconnected from the control panel.

8. The pipe and joints shall also be considered acceptable when the time required in minutes for pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following tables:

PIPE DIAMETER (Inches)	MINUTES
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

9. If the installation fails to meet this requirement, the Contractor shall determine at his own expense the source of leakage.

10. The Contractor shall repair or replace all defective materials and/or workmanship.

11. Pressure test concrete sewer manholes by the negative air pressure (vacuum) test as per ASTM C1244M.

3.09 CLOSED CIRCUIT TELEVISION INSPECTION

A. Contractor shall inspect the sewer lines with a color television camera. The camera test shall be supervised and witnessed by the City Engineer or the City Inspector and shall be done as follows:

1. The lines and lateral connections will be televised at the cost of the Developer until the lines are accepted by the City.

2. The camera shall have "PAN and TILT" capability for detailed wall, joint, and service inspection. The camera shall be pulled through the sewer line or propelled with a tractor.

3. The light intensity and camera focus shall be adjusted to obtain a good clear picture at all times.

4. The operator shall control the travel speed of the camera so that the walls of the pipe can be clearly viewed. The speed shall not be greater than 20 feet per minute. The operator shall stop and inspect each service, obstruction, or pipe deformation. Locations of each shall be noted and included in the final Inspection Report.

5. Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected . The maximum acceptable limits for 8 to 10 inch pipes are: 0.25 inches for joint separations, 0.5 inches for low spots, and 0.25 inches for chipped ends.

6. A flat or reverse grade will not be acceptable.

7. If the pipeline is found unacceptable, the problem shall be corrected by the contractor and re-televised.

8. The television inspection process shall be done immediately after running water in the pipe and no visible discharge occurs at the downstream manhole.

9. Television inspection must be scheduled at least one (1) week in advance of date inspection is required.

10. A typed log of the closed circuit television inspection with a digital CD/DVD video shall be turned over and become the property of the City. The Inspection Report shall contain the following:

    a. Location of sewer line and direction of flows
    b. Connecting manhole numbers with starting and ending manhole
    c. Manhole condition, flowline condition, and cover conditions
    d. Pipeline size, material, and condition, with defect locations noted from center of manhole
    e. Location of services located as to distance from center of manhole
    f. Date of inspection, name of contractor, and signature of operator/logger

11. After cleaning and inspection have been completed and any defects are corrected and accepted, the lines shall be tested for leakage by methods discussed in Section 3.08.

3.10 PIPE TESTING SCHEDULE

A. Irrigation:

1. Alignment and grade test.

2. Pressure test.

3. Operational Testing:
   a. Perform operational testing after hydrostatic test is complete, backfill is in place and sprinkler heads adjusted to final position.
   b. Demonstrate system meets coverage requirements and automatic controls function properly.
   c. Coverage requirements are based on operation of 1 circuit at a time.

B. Sanitary Sewers:

1. Displacement test.

2. Pressure test for gravity pipeline systems.

3. Pressure test for pressure pipeline systems.

4. Video test for sanitary sewers.

5. Pressure test manholes.

C. Subdrains:

1. Alignment and grade test.

2. Obstruction test.

3. Non-rigid pipe deflection test (if applicable)

D. Storm Drains:

1. Alignment and grade test.

2. Obstruction test.

3. Non-rigid pipe deflection test (if applicable).

4. Pressure test for pressure pipeline systems.

E. Potable Water System:

1. Obstruction test.

2. Bacteria test.

3. Pressure test
4. If pressure test fails and line repaired, the bacteria test is required.

END OF SECTION