SECTION 13 1402 – WATER FEATURE PIPE TESTING AND CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Testing and Cleaning of the piping system

B. Related Sections:

1. SECTION 13 1106 – WATER FEATURE TRENCHING
2. SECTION 13 1401 – WATER FEATURE PIPE AND FITTINGS
3. SECTION 13 1511 – WATER FEATURE VALVES, GAUGES, AND METERS

1.2 SUBMITTALS FOR REVIEW

A. SECTION 01 3300 – SUBMITTAL PROCEDURES

B. Prior to installing pipe, provide a plan to remove foreign materials from pipes that may have gained access into newly installed or repaired main lines.

C. Certification: Provide certification that the piping system to be tested has been thoroughly cleaned and meets or exceeds specified requirements prior to testing pipeline.

D. Test Reports: Provide results of every test passing or failing. The Contractor and Owner's Representative shall sign each Test Report. Reports shall include a description of the pipeline being tested, date, start time, pressure at the start of the test, pressure at the second part of the test, ending time, and pressure at the end of the test. If any additional water was added to the pipeline during the test, the quantity and times must be noted. Any other comments specific to the test shall also be noted.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. All newly laid and installed piping shall be subjected to a Hydrostatic Pressure Test.

B. Prior to test, verify all piping, valves, and fittings have been laid and properly installed. Verify bolts on all flanges are tight and secure.

C. Test each pipeline within five (5) days after completion of the pipeline section. Each section of pipeline must successfully pass the Pressure Test and have been thoroughly flushed prior to submittal of payment.

D. The Hydrostatic Pressure Test shall not be done in conjunction with a line disinfection process.

E. A Leakage Test shall be conducted in connection with the Pressure Test, if and only if directed by the Engineer.

F. The Contractor shall furnish all the necessary equipment and manpower for completing the Hydrostatic Pressure Test and Leakage Test.

G. The Contractor shall provide sufficient flanges, plugs, or caps so that a pipe that has successfully passed the Tests can and shall remain under pressure for the duration of the construction period or until start-up.

H. Keep all personnel a safe distance away from test points during testing.

I. The test section shall always be supervised during the test.

J. All piping shall be restrained against possible movement from catastrophic failure at joints and connections. Never conduct Test on unrestrained piping.

K. All joints of test sections shall be properly cured and/or cooled before testing can begin.

L. Mechanical connections must be completely installed and tightened per manufacturer's instructions.

M. If backfill provided restraint, backfill shall be properly placed and compacted. Joints and connections must be exposed for inspection.

N. End closures must be suitable for pressure service and pressure-rated for the test pressure.

O. Fill out appropriate worksheet indicating information of section tested. Samples of worksheets are found immediately following this specification.

3.2 HYDROSTATIC PRESSURE TESTS FOR PVC PIPE AND FITTINGS

A. Test the pipeline at 1.5 times the maximum static pressure anticipated in the pipeline, or at 70 psi (482 kPa), whichever is greater.

B. Prior to testing, the pipeline shall be flushed or vacuumed to remove all construction debris and foreign material from the pipeline.

C. Perform the Hydrostatic Pressure Test using the following procedure:

1. Install flanges on both ends of the pipeline and at any tees or branches in the line as required
2. Install a test pressure gauge at the lowest end of the pipeline. The full scale reading of the test gauge shall not be more than 15-percent of the specified test pressure. For a test pressure of 70 psi (482 kPa) the maximum gauge reading would be 80 psi (551 kPa).
3. Slowly fill the pipeline with clean water.
4. Expel any air from the pipeline, make necessary taps at points for highest elevation before test made and insert plugs after the test has been completed.
5. Bring pipe to specified test pressure plus 10 psi (69 kPa), by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pressure on the gauge must be corrected to account for the elevation for which the gauge is installed.
6. Maintain the specified test pressure plus 10 psi (69 kPa) for one (1) hour by adding additional water as required.
7. At the end of the hour, reduce the pressure in the line by 10 psi (69 kPa) to the specified test pressure.
8. Immediately after the pressure has been reduced to the specified test pressure begin Part 2 of the test. Part 2 of the test shall last for two (2) hours.
9. A successful test shall consist of maintaining the specified test pressure for the entire two (2) hour duration without a drop in pressure on the test pressure gauge.
10. During the test period, neither additional water nor air is to be added to the pipeline, unless a Leakage Test had been requested by the Engineer, and only if requested.

D. After the Hydrostatic Pressure Test has been completed the line shall be flushed as described in Section 3.3.

3.3 LEAKAGE TEST FOR PVC PIPE AND FITTINGS ONLY

A. The Leakage Test shall serve as a secondary acceptance test and is to be used solely at the discretion of the Engineer and if the Hydrostatic Pressure Test failed.

B. The Test shall be performed in the same manner as the Hydrostatic Pressure Test described in Section 3.2. However, once the two (2) hour period described in Section 3.2.C.8 is started, water shall be added to the system as required to maintain the specified test pressure for the entire two (2) hour duration.

C. The amount of leakage is defined as the quantity of water added to the pipeline to maintain the specified test pressure for the entire two (2) hours.

D. No pipe installation will be accepted until the leakage test is less than 10 gallons per mile (38 liters per 1,609m), per 2-inch (50mm) diameter, per day.

3.4 HYDROSTATIC PRESSURE TEST FOR HDPE PIPE AND FITTINGS

A. Test Section:

1. Test section length is to be determined by the capacity of the testing equipment. Testing equipment must be able to fill and pressurize the test section in two (2) hours or less.
2. Before applying test pressure, allow time for the water in the test section to equalize to a common temperature.
3. Measure temperature of the test section once water and pipe have reached a common temperature.

B. Test Pressure

1. Install flanges on both ends of the pipeline and at any tees or branches in the line as required.
2. Install a test pressure gauge at the lowest end of the pipeline. The full scale reading of the test gauge shall not be more that 15-percent of the specified test pressure. For a test pressure of 70 psi (482 kPa) the maximum gauge reading would be 80 psi (551 kPa).
3. The base test pressure is 70 psi (482 kPa). Test pressure may be reduced when the test section is at elevated temperatures as follows:

   a. Temperature <= 80 °F (27 °C): Multiplier = 1.00
   b. Temperature <= 90 °F (32 °C): Multiplier = 0.90
   c. Temperature <= 100 °F (38 °C): Multiplier = 0.80
   d. Temperature <= 110 °F (43 °C): Multiplier = 0.75
   e. Temperature <= 120 °F (49 °C): Multiplier = 0.65
   f. Temperature <= 130 °F (27 °C): Multiplier = 0.60
   g. Temperature <= 140 °F (27 °C): Multiplier = 0.50

C. Test Duration

1. The maximum test duration is eight (8) hours including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize the test section.
2. If the test is not completed due to leakage, equipment failure, or for any other reason, depressurize the test section completely, and allow it to relax for at least eight (8) hours before pressurizing the test section again.

D. Test Procedure:

1. Fill restrained test section completely with clean water. Allow time for water and pipe to come to a common temperature.
2. Determine section testing pressure: 70 psi (482 kPa) * Temperature Multiplier (Section 3.4.B.3)
3. Ensure that no air is trapped in the test section.
4. Gradually pressurize the test section to section testing pressure and maintain test pressure for three (3) hours. During this expansion phase add water as needed to maintain section test pressure.
5. After the three (3) hour expansion period, measure and record the amount of make-up water required to maintain section test pressure for two (2) hours.
6. Failure of the test is determined by the amount of water required to maintain section test pressure. Make-up water shall not exceed the following quantities per 100-feet (30.5m).

Nominal Pipe Size		**Make-up Water**	
(inches)	**(mm)**	**(gallons)**	**(liters)**

Nominal Pipe Size		Make-up Water	
(inches)	(mm)	(gallons)	(liters)
1-1/4	32	0.10	0.38
1-1/2	40	0.10	0.38
2	50	0.11	0.42
3	80	0.15	0.57
4	100	0.25	0.97
5	125	0.38	1.44
5-3/8	137	0.41	1.55
6	150	0.60	2.27
7-1/8	180	0.70	2.64
8	200	1.00	3.78
10	250	1.30	4.92
12	300	2.30	8.70
13-3/8	340	2.50	9.50
14	350	2.80	10.60
16	400	3.30	12.50
18	450	4.30	16.3
20	500	5.50	20.80
22	550	7.00	26.5
24	600	8.90	33.70
26	650	10.00	37.80
28	700	11.10	42.00
30	750	12.70	48.00
32	800	14.30	54.00
34	850	16.20	61.00
36	900	18.00	68.00

7. At the conclusion of the test, carefully depressurize the test section by the controlled release of the test water.

3.5 FLUSHING PIPELINES FOR PVC AND HDPE PIPE

A. All pipelines shall be thoroughly flushed or vacuumed before and immediately after the Pressure Test.

B. If the line is damaged after the initial Pressure Test, the lines shall be thoroughly flushed or vacuumed and the Pressure Test repeated.

C. Flushing will only remove the lighter solids and cannot be relied upon to remove heavy material or debris that was allowed to enter the pipe during installation.

D. Extreme care and thorough inspection shall be practiced during installation of pipelines to prevent small stones, pieces of concrete, particles of metal, sand, dirt, or other foreign material from gaining access into the pipelines.

E. Once the line has been thoroughly flushed, flanges, plugs, and/or caps shall be installed on the pipeline. The pipe shall be filled with water and shall remain full for the duration of construction or until start-up.

3.6 QUALITY ASSURANCE

A. Should any test of pipe fail to maintain pressure or exceed the allowable leakage for the entire two (2) hour duration, the Contractor, at his own expense, shall locate and repair or replace defective pipe, fittings, or connections and then re-test the pipe again until test results are within the specified allowances.

B. The Engineer or Owner may direct the Contractor to repair specific leaks regardless of the test results, if leaks are found in the pipeline.

END OF SECTION

(Pertains to Section 13 1402.3.2) Date:_____

PVC PIPE PRESSURE TEST For: _____

SITE CONDITIONS:

Ambient Air Temperature: _____ °F or °C (circle one)

Description of section being tested: _____

_____

_____

Nominal Pipe Diameter: _____ inches or mm (circle one)

Pipe Length: _____ Feet or Meters (circle one)

Testing Media: _____ (Water or Other, please specify)

Maximum Pressure Reading: _____ psi or kPa (circle one)

TESTING DATA:

Section Testing Pressure: _____ psi or kPa (circle one)

Initial time of bringing section to test pressure + 10 psi (69 kPa): _____ a.m. or p.m.

Time when pressure test began: _____ a.m. or p.m.

Time when pressure test ended: _____ a.m. or p.m.

Pressure at end of test: _____ psi or kPa (circle one)

Test Passed? _____ Yes or _____ No

_____

(Contractor's Signature)

_____

(Owner's Representative's Signature)

(Pertains to Section 13 1402.3.4) Date:_____

HDPE PIPE PRESSURE TEST For: _____

SITE CONDITIONS:

Ambient Air Temperature: _____ °F or °C (circle one)

Testing Section Temperature: _____ °F or °C (circle one) Temperature Multiplier: _____

Description of section being tested: _____

_____

_____

Nominal Pipe Diameter: _____ inches or mm (circle one)

Pipe Length: _____ Feet or Meters (circle one)

Testing Media: _____ (Water or Other, please specify)

TESTING DATA:

Section Testing Pressure (Testing Pressure * Temperature Multiplier): _____ psi or kPa

Time Test Section filling began: _____ a.m. or p.m.

Time when Section Test Pressure is achieved: _____ a.m. or p.m.

Time when pressure test began: _____ a.m. or p.m.

Time when pressure test ended: _____ a.m. or p.m.

Amount of water added during Pressure Test: _____ gallons or liters (circle one)

Test Passed? _____ Yes or _____ No

_____

(Contractor's Signature)

_____

(Owner's Representative's Signature)