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SECTION 15 31 13

TESTING OF SANITARY SEWER GRAVITY MAINS

PART 1.00 - GENERAL

1.01 Description

The work in this Section covers the requirements for conducting pressure testing and deflection testing for all new sanitary sewer gravity mains. Testing for Sanitary Sewer Manholes is specified with Section 15 39 13. Testing for Sanitary Sewer Force Mains is specified within Section 15 34 00.

1.02 Quality Assurance

- A. The Contractor shall use sufficient workmen and competent supervisors in the execution of this portion of the work to ensure adequate and proper testing.
- B. Testing shall be in segments from manhole to manhole and all stubs outs and/or service laterals for future connection shall be included in testing.
- C. Copies of all certified reports and logs of all tests and inspections conducted shall be submitted to the Engineer.

PART 2.00 - PRODUCTS

2.01 Low Pressure Air Testing Materials

The contractor shall provide all materials, labor, equipment, tools etc to perform all work and services necessary for and incidental to a complete low pressure air test of the sanitary sewer gravity system.

A. Pressure Gauge

1. Pressure gauge shall have a four inch (4") minimum diameter face with maximum gradation increments of .10 psi.

B. By-pass Pump

1. Pump or pressurizing equipment shall have a pressure relief valve or regulator to avoid damaging the lines.
2. The Contractor shall provide all temporary plugs and blocking as necessary for administering the required testing

2.02 Deflection Test Materials

The Contractor shall provide all materials, labor, equipment, tools etc to perform all work and services necessary for and incidental to a complete deflection Test. Final long term deflection shall not exceed five percent (5%).

A. Mandrel

1. The mandrel (go/no-go) device shall be cylindrical in shape and constructed with nine (9) or ten (10) evenly spaced arms or prongs. Mandrels with fewer arms (in odd or even numbers) will be rejected as insufficiently accurate. The contact

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length "L" of the mandrel's arms and the actual mandrel diameter "D" (ID of the proving ring) shall equal the dimensions in Table 1. Critical mandrel dimensions shall carry a tolerance of ± 0.01 inch. Larger mandrel dimensions shall be provided by the Engineer.

TABLE 1

NOMINAL DIAMETER	L	ASTM D3034 SDR 35	
		5 %	7.5 %t
8"	8"	7.52"	7.33"
10"	10"	9.41"	9.16"
12"	10"	11.19"	10.90"
15"	12"	13.70"	13.34"

2. The Engineer shall be responsible for approving the mandrel. Proving rings may be used to assist in this. Drawings of the mandrel with complete dimensions shall be furnished by the Contractor to the engineer for each diameter and specification of pipe.

2.03 Television Inspection

- A. The City will perform a television inspection to verify accuracy of alignment, freedom from debris or obstruction, displacement of gaskets or joints and leaks at joint and manhole connections. Any of the above discrepancies observed shall be corrected by the Contractor at no additional cost to the City.
- B. The cost of the initial television inspection and the first reinspection to confirm correction of previously identified deficiencies will be borne by the City. In the event additional television inspections are necessary due to inadequate or otherwise unacceptable repairs, the costs for such inspection shall be charged to the Contractor.

PART 3.00 - EXECUTION

3.01 Pre Testing

A. General

1. Gravity mains will be checked by the Engineer to determine whether any displacement, cracking, deflections or any other damage to the pipe has occurred, after the trench has been filled to two feet (2') above the pipe and tamped as specified; and upon completion of the project. The test will be physical inspection of each joint for pipe of forty-eight inch (48") in diameter and larger or, for pipes smaller than forty-eight inch (48") in diameter, by light flashed between manholes, or, if the manholes have not as yet been constructed, between the locations of the manholes by means of a flashlight or by reflecting sunlight with a mirror. If the interior or exterior of the pipe shows any misaligned pipe,

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displaced pipe, concrete pipe with cracks greater than 0.01", deflections greater than five percent (5%) for steel and plastic sewer pipe, or any other defects, the defects designated by the Engineer shall be remedied by the Contractor at his expense.

2. Prior to other tests, all sewer outfall lines shall be cleaned by flushing, pigging, or flushing with an appropriately sized sewer cleaning ball. In some cases, cleaning by high velocity jet or other method may be necessary.
 3. All low pressure tests and deflection tests shall be witnessed by the Engineer.
- B. Low Pressure Air Test
1. The Contractor shall flush and clean the sewer line prior to testing. Plug all pipe outlets sufficient to resist the test pressure.
 2. During construction, all manhole connections for future laterals shall be properly capped or plugged to avoid loss of test pressure.
 3. Determine the test duration for the section under test by computations from the applicable equations as per ASTM C828 for ductile iron pipe, and reinforced concrete pipe or as per UNI-B-6 for PVC corrugated pipe and PVC solid-wall pipe. (See Table 1 or 2)
 4. Determine groundwater elevation and head above the section of line to be tested. Adjust test pressure for groundwater by adding 0.43 psig per foot of groundwater head above pipe invert (each foot of groundwater divided by 2.31 is equivalent to 0.43 psig.) At no time shall the starting test pressure exceed 9.0 psig.
 5. The pressure holding time is based on an average holding pressure of 3 psig or a drop from 3.5 to 2.5 psig.

**TABLE 1
AIR TEST TABLE
FOR DUCTILE IRON PIPE, VITRIFIED CLAY PIPE,
AND CONCRETE PIPE
(Based on Equations from ASTM C828)**

SPECIFICATION TIME (MIN:SEC) REQUIRED FOR PRESSURE DROP FROM 3½ TO 2½ PSIG WHEN TESTING ONE PIPE DIAMETER ONLY

LENGTH OF (FT.)	PIPE NOM. SIZE (IN.)								
	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30	9:55	11:20
175	0:31	1:09	2:03	3:13	4:37	7:05	8:30	9:55	11:20

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200	0:35	1:19	2:21	3:40	5:17	7:05	8:30	9:55	12:06
225	0:40	1:29	2:38	4:08	5:40	7:05	8:30	10:25	13:36
250	0:44	1:39	2:56	4:35	5:40	7:05	8:31	11:35	15:07
275	0:48	1:49	3:14	4:43	5:40	7:05	9:21	12:44	16:38
300	0:53	1:59	3:31	4:43	5:40	7:05	10:12	13:53	18:09
350	1:02	2:19	3:47	4:43	5:40	8:16	11:54	16:12	21:10
400	1:10	2:38	3:47	4:43	6:03	9:27	13:36	18:31	24:12
450	1:19	2:50	3:47	4:43	6:48	10:38	15:19	20:50	27:13
500	1:28	2:50	3:47	5:14	7:34	11:49	17:01	23:09	30:14

**TABLE 2
AIR TEST TABLE
FOR CORRUGATED AND SOLID-WALL POLYVINYL CHLORIDE PIPE
(Based on Uni-Bell's Recommended Practice)**

SPECIFICATION TIME (MIN:SEC) REQUIRED FOR PRESSURE DROP OF 1 PSIG FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

LENGTH OF (FT.)	PIPE NOM. SIZE (IN.)						
	4	6	8	10	12	15	18
100	3:46	5:40	7:34	9:26	11:20	14:10	17:00
150	3:46	5:40	7:34	9:26	11:20	14:10	19:13
200	3:46	5:40	7:34	9:26	11:24	17:48	25:38
250	3:46	5:40	7:34	9:53	14:15	22:15	32:03
300	3:46	5:40	7:36	11:52	17:05	26:42	38:27
350	3:46	5:40	8:52	13:51	19:56	31:09	44:52
400	3:46	5:42	10:08	15:49	22:47	35:36	51:16
450	3:46	6:24	11:24	17:48	25:38	40:04	57:41
	0.380 (L)	0.854 (L)	1.520 (L)	2.374 (L)	3.418 (L)	5.342 (L)	7.692 (L)

- The Contractor shall manipulate the air valves and gauges during the test in the presence of the Engineer or his representative. Add air until the internal air pressure of the sewer line is raised to 4.0 psig. After an internal pressure of 4.0 psig is obtained in the pipe, allow time for the pressure to stabilize. The pressure will normally show some drop until temperature of the air in the test section of pipe stabilizes.
- When the pressure has stabilized and is at or above the starting test pressure of 3.5

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psig, commence the test.

8. Before starting the test, the internal pressure in the section of pipe being tested may be allowed to drop to 3.5 psig or the adjusted value due to groundwater head. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psig during the test period, the line has failed and the Contractor shall not be paid for his work until the condition is corrected and the line does pass the test. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.
9. No one shall be allowed inside the manholes during testing.

C. Deflection Test with Mandrel

1. The Contractor shall have a deflection test conducted no earlier than thirty days after reaching final trench backfill for all PVC pipe provided, in the opinion of the Engineer, that sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth.
2. If this densification condition cannot be achieved in the time after installation of the pipe but prior to the project completion date, then the testing of pipe deflection or deformation shall be conducted using a mandrel for which the size has been increased to measure one-third (1/3) less of the deflection allowance. Under these testing conditions the entire length of the sewer outfall shall be tested by means of a rigid go-no-go mandrel to ensure that a pipe deflection or deformation of Three and one-third (3-1/3%) percent or greater has not occurred.
3. The go-no-go mandrel shall be hand pulled by the Contractor through the sewer outfall. No mechanical equipment such as winches or heavy machinery shall be used for pulling or pushing the mandrel through the sewer outfall.

D. Correction and Retesting

1. Any sections of sewer outfall that do not pass minimum test requirements for any of testing parameters enumerated hereinbefore shall be replaced and/or corrected prior to retesting when directed by the Engineer.
1. No additional compensation shall be paid to the Contractor for correcting and retesting defective sewer outfall lines.

PART 4.00 – MEASUREMENT AND PAYMENT

4.01 Testing of Sanitary Sewer Gravity Mains

Work associated with Testing of Sanitary Sewer Gravity Mains shall be considered incidental to the work performed during installation of water mains described within Section 15 13 00.

END OF SECTION

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