

## **SANITARY GRAVITY SEWER LINE TESTING AND ACCEPTANCE**

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### **PART 1 GENERAL**

#### 1.1 SECTION INCLUDES

- A. Low Pressure Air Test
- B. Deflection Test

#### 1.2 RELATED SECTIONS

- A. Section 02730 – Sanitary Gravity Sewer Lines
- B. Section 02732 – CCTV Inspection of Gravity Sewer Lines

#### 1.3 REGULATORY REQUIREMENTS

- A. Conform to SCDES Standards for Wastewater Facility Construction: R.61-67.

### **PART 2 EXECUTION**

#### 2.1 GENERAL

- A. Compaction testing, if required by the Engineer, will be performed in accordance with ASTM D1557.
- B. Moisture content testing, if required by the Engineer, will be performed in accordance with ASTM D1557.
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to the Owner.
- D. Outward (exfiltration) or inward (infiltration) leakage of gravity sewers shall not exceed two hundred (200) gallons per inch of pipe diameter per mile per day.
- E. Locate and repair defective joints, pipes or manholes, and retest until the allowable test rates are within the allowances specified below.
- F. Testing sequences shall be as follows:
  - 1. Deflection test
  - 2. Low-pressure air test
  - 3. CCTV inspection

## 2.2 DEFLECTION TEST

- A. Perform deflection test on all flexible pipe. For PVC gravity mains 10" or larger for depths between 15'-25' deep use Multi Fittings/HARCO 2-piece heavy wall DR18 rated tee-wyes for service connections. Multi Fittings – Blue Brute Heavy Wall Tee is no longer accepted for these service connections to gravity main because they cannot be mandrel tested through without issues. For depths greater than 25', P401 lined (or approved equal) DIP tees shall be used for service connections. Where DIP tees are used, mandrel pull is not required. All other cases where PVC is used, mandrel pull is required.
- B. Deflection shall not exceed 5%.
- C. Perform initial deflection testing after the final backfill and compaction has been in place at least thirty (30) calendar days and prior to placing the sewer lines into operation. Perform final deflection testing during the 12th month of operation and prior to expiration of the Contractor's warranty and performance bond.
- D. Perform deflection test using a rigid ball or mandrel having a diameter equal to 95% of the inside diameter of the pipe. Perform test without use of mechanical pulling devices.

5% Mandrel (In.)			
Nominal OD	C900, DR-18	C905, DR-18	D3034, SDR-26
6"	5.64		5.33
8"	7.37		7.11
10"	9.01		8.87
12"	10.70		10.55
14"		12.40	
16"		14.09	
18"		15.78	
20"		17.47	
24"		20.84	

## 2.3 LOW PRESSURE AIR TEST

- A. Perform low pressure air test in accordance with ASTM F1417 and UNI B-6-90.
- B. Equipment
  - 1. Low pressure air testing is to be conducted by the Contractor using an air source and other specified equipment provided by the same, which is properly calibrated and oil free. The air source shall utilize a single control panel consisting of a main shut-off

valve, pressure-regulating valve, 9 psig pressure relief valve, input pressure gage, and continuous monitoring pressure gage having a range of pressure from 0 to at least 10 psi with minimum divisions of .1 psi. The pressure gage used for continuous monitoring should be at least 4" in diameter and have an accuracy of + .04 psi.

2. Separate air hoses shall be provided for: the introduction of the low pressure air from the control panel to the sealed line, the constant monitoring of air pressure build-up in the line, and the inflation of pneumatic plugs from the control panel.
3. Either mechanical or pneumatic plugs may be used to isolate sections of sewer main to be tested so long as they have the capability to resist the pressures inside the sewer line associated with this test. As well as isolating the sewer main itself by plugging manhole inverts, all service laterals, stub outs, and other fittings of this type should be properly sealed so as not to cause a failure of this test.

C. Procedure

Note: Conduct deflection test prior to low-pressure air test.

Lines must be cleaned by flushing or by other means before the low-pressure air test is to begin.

1. Isolate the sewer line to be tested with the plugs referenced above and ensure that all other outlets from which air could escape are properly sealed. In this step of the procedure, it is necessary to inspect the manhole invert being plugged to be sure that it has no damage which will be covered by the plug and not detected with the low-pressure air test.
2. Determine the duration of the test by using the formula found below or by consulting the accompanying tables at the end of this section.

$$T = 0.085 DK/Q$$

Where: T = Shortest time in seconds allowed

for the air pressure to drop 1.0  
psig (or .5 psig in circumstances  
where a shorter test duration is  
desired)

K = .000419 DL, but not less than 1.0  
Q = .0015 cubic feet/minute/square foot  
internal pipe surface area  
D = Nominal pipe diameter in inches  
L = Length of pipe being tested in feet

3. Begin the test by connecting the air source to the inlet tap. Slowly add air until the internal pressure of the test section reaches a pressure 4.0 psig greater than the average back pressure of any groundwater above the pipe as long as the internal pressure does not exceed 9.0 psig. If ground water back pressure exists, it must be quantified by the Engineer prior to testing.
4. After the constant pressure of 4.0 psig (greater than the average ground water back pressure) is attained, the air supply should be controlled to keep the pressure at 4.0 psig (greater than the average ground water back pressure) for at least two minutes allowing the entering air's temperature to reach equilibrium with the temperature of the pipe wall.
5. Once the pressure has stabilized to 4.0 psig (greater than the average ground water back pressure) disconnect the air supply from the control panel. Observe the continuous monitoring gage and decrease the internal pressure to no less than 3.5 psig (greater than the average ground water back pressure). At a reading of 3.5 psig or within the range of 3.5 to 4.0 psig, stop decreasing the pressure and commence timing with a stopwatch or any other timing device capable of being 99.8 percent accurate.
6. Once the predetermined time period from the formula or table above has elapsed, observe the continuous monitoring gage to obtain the amount of pressure lost during the test duration. If the pressure drop is found to be less than 1.0 psig (or 0.5 psig in circumstances where a shorter test duration is desired), the section is presumed to be free of any leaks or defective joints. If the pressure drop is 1.0 psig or greater (0.5 psig or greater in circumstances where a shorter test duration is desired), the test section has failed due to excessive pressure loss. When low-pressure air testing of a sewer line results in a failure the Contractor, at his/her own expense, shall detect the leak or

defect and repair or replace whatever is necessary to remedy such defect in a manner acceptable to the Owner.

TABLE 1: MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft.)	Time for Longer Length (sec)	Specification Time (min:sec) for Length L Shown Below in feet								
				100	150	200	250	300	350	400	450	
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	230:46

(Table taken from UNI-B-6-90)

TABLE 2: MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft.)	Time for Longer Length (sec)	Specification Time (min:sec) for Length L. Shown Below in feet							
				100	150	200	250	300	350	400	450
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:23	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:46	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	120:34	115:23

(Table taken from UNI-B-6-90)

## 2.4 CCTV INSPECTION

- A. See Appendix G 02732 CCTV of Gravity Sewer Lines for specifications.

## 2.5 FINAL ACCEPTANCE PRIOR TO SUBMISSION FOR PERMIT TO OPERATE (PTO)

- A. No pipeline installation will be accepted until all known and visible leaks have been repaired
- B. BCWS will conduct a final walkthrough inspection after all testing is complete normally in conjunction with walkthrough inspection of water infrastructure and only when site is ready. Should items not be ready for final inspection, BCWS does reserve the right to reschedule until all fully addressed. This is a final acceptance inspection, not a punch list generator. Minimum requirements for walkthrough inspection are below.
  - 1. All roadside curbing in and cleaned with applicable markings applied so that field curb markings are visible
  - 2. All weather reasonable access roads must be rocked and roadside curbing complete (if applicable) prior to testing and ready for pavement before final walkthrough
  - 3. Final grading complete within utility locations
  - 4. All areas where manholes fall within pavement shall be paved or grade stake set at final pavement height
  - 5. All property corner frontage staked
  - 6. All drainage easement frontage corners staked
  - 7. All BCWS Utility Easement frontage staked where applicable
  - 8. Record drawings brought to inspection by EOR
  - 9. All sewer main lines cleaned and ready for inspection
  - 10. All sewer services on property corner/property line as called out on plans within the BCWS UE and staked
  - 11. All sewer service cleanout locations to have proper concrete collar and lid set to grade
  - 12. All Manhole frame and covers set to final grade
  - 13. All fiber glass markers in place (For manholes set in overgrown locations/underdeveloped locations)
  - 14. All manholes requiring epoxy coating shall be complete
  - 15. All manholes free from infiltration and all invert, channel, and inside drop work complete
  - 16. All manholes fully in/out of sidewalk, watertight frame and cover if within
  - 17. All BCWS owned Manholes to have BCWS Sewer stamped on lid
  - 18. All curbs (if applicable) marked for service and MH locations

19. Manhole plug to be removed at final inspection barring issues that would prevent removal
- C. Certify that all testing has been successfully completed and items noted on walkthrough inspections are fully corrected. Line will only be fully accepted after items above are complete and all closeout documentation submitted per Appendix F27.
- D. If newly installed line has successfully passed testing after construction but fails to receive a permit to operate issued by SCDES within 1 year, BCWS will require the line be tested again prior to final acceptance.
- E. Prior to BCWS Engineering field staff completing a final walkthrough inspection with the EOR, it is required by the Engineer of Record(EOR)/Stakeholder/Contractor to submit a copy of a signed off checklist covering all walkthrough inspection items identified on BCWS Final Inspection Checklist posted on county website located at the following website.  
<https://bcws.berkeleycountysc.gov/departments/engineering/eng-panels/>

At minimum signatures on this checklist should include the EOR and contractor responsible for preparing the site for final inspection.

**END OF SECTION**