

SECTION 33 01 32
SEWER AND MANHOLE TESTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gravity Sewer Testing:
 - a. Low-pressure Air Test.
 - b. Exfiltration Test.
 - c. Infiltration Test.
 - 2. Deflection Testing of Plastic Piping.
 - 3. Manhole Testing:
 - a. Vacuum Test.
 - b. Exfiltration Test.

- B. Related Sections:
 - 1. Section 33 05 14 - Utility Manholes and Structures.
 - 2. Section 33 31 00 - Sanitary Utility Sewerage Piping.
 - 3. Section 33 41 00 - Storm Utility Drainage Piping.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C828 - Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
 - 2. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
 - 3. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
 - 4. ASTM D2122 - Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Submit the following prior to start of testing:
 - 1. Testing procedures.
 - 2. List of test equipment.
 - 3. Testing sequence schedule.
 - 4. Provisions for disposal of flushing and test water.
 - 5. Certification of test gauge calibration.
 - 6. Deflection mandrel drawings and calculations.

- C. Test Reports: Indicate results of manhole and piping tests.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that manholes and piping are ready for testing.
- B. Verify trenches are backfilled.
- C. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.

3.2 PIPING PREPARATION

- A. Flush and clean piping.
- B. Assist Engineer in lamping gravity piping.
 - 1. Engineer will perform lamping operation by shining light at one end of each pipe section between manholes; observe light at other end; reject pipe not installed with uniform line and grade
 - 2. Remove and reinstall rejected pipe sections; re-clean and assist engineer with re-lamping.
- C. Plug outlets, wye-branches, and laterals; brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Notify Engineer 72 hours in advance of tests and have witness tests.

3.4 TESTING GRAVITY SEWER PIPING

- A. Low-pressure Air Test:
 - 1. Perform test in accordance with applicable portions of ASTM 828 and ASTM 924.
 - 2. Test each section of gravity sewer piping between manholes.
 - 3. Introduce air pressure slowly to approximately 4 psig.
 - 4. Determine groundwater elevation above spring line of pipe. For every foot of groundwater above spring line of pipe, increase starting air test pressure by 0.43 psig; do not increase pressure above 10 psig.
 - 5. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or increased test pressure as determined above when groundwater is present. Start test.
 - 6. Determine test duration for sewer section with single pipe size from the following table. Do not make allowance for laterals.

Nominal Pipe Size (inches)	Minimum Test Time (min/ 100 feet)
3	0.2
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2

30	4.8
33	5.4
36	6.0

7. Record drop in pressure during test period; when air pressure has dropped more than 1.0 psig during test period, piping has failed; when 1.0 psig air pressure drop has not occurred during test period, discontinue test and piping is accepted.
8. When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between manholes.

B. Exfiltration Test:

1. Test pipe larger than 36 inch diameter with exfiltration test not exceeding 100 gallons for each inch of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of 2 feet.

C. Infiltration Test:

1. Use only when gravity piping is submerged in groundwater minimum of 4 feet above crown of pipe for entire length being tested.
2. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter for each mile per day for section under test; include allowances for leakage from manholes. Perform test with minimum positive head of 2 feet.

3.5 DEFLECTION TESTING OF PLASTIC PIPING

- A. Perform vertical ring deflection testing on PVC and ABS sewer piping after backfilling has been in place for at least 30 days but not longer than 12 months.
- B. Allowable maximum deflection for installed plastic sewer pipe is limited to 5 percent of original vertical internal diameter.
- C. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.
- D. Perform deflection testing using properly sized rigid ball or 'Go, No-Go' mandrel.
- E. Perform test without mechanical pulling devices.
- F. Locate, excavate, replace, and retest pipe exceeding allowable deflection.

3.6 TESTING MANHOLES

- A. General: Test using air whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. Test manholes with manhole frame set in place.
- B. Vacuum test in accordance with ASTM C1244 and as follows:
 1. Plug pipe openings; securely brace plugs and pipe.
 2. Inflate compression band to affect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
 3. Determine test duration for manhole from the following table:

Manhole Diameter	Test Period
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4 feet	60 seconds
5 feet	75 seconds
6 feet	90 seconds

4. Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.
5. When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

C. Exfiltration Test:

1. Plug pipes in manhole; remove water in manhole; observe plugs over period of not less than 2 hours to ensure there is no leakage into manhole.
2. Determine groundwater level outside manhole.
3. Fill manhole with water to within 4 inches of top of cover frame. Prior to test, allow manhole to soak from minimum of 4 hours to maximum of 72 hours; after soak period, adjust water level inside manhole to within 4 inches of top of cover frame.
4. Measure water level from top of manhole frame; at end of 4 hour test period, again measure water level from top of manhole frame; compute drop in water level during test period.
5. Manhole exfiltration test is considered satisfactory when drop in water level is less than values listed in table below:

Manhole Depth (feet)	Allowable Leakage (Inches for Manhole Diameter)		
	4 feet	5 feet	6 feet
4	0.11	0.14	0.17
6	0.17	0.21	0.26
8	0.23	0.29	0.35
10	0.28	0.35	0.42
12	0.34	0.43	0.51
14	0.40	0.50	0.60
16	0.45	0.56	0.68
18	0.51	0.64	0.77
20	0.57	0.71	0.86
22	0.62	0.78	0.93
24	0.68	0.85	1.02
26	0.74	0.93	1.11
28	0.79	0.99	1.19
30	0.85	1.06	1.28

6. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.

END OF SECTION