

SECTION 01666

STORM SEWER SYSTEM TESTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section concerns the testing of storm sewer trunk lines, laterals, manholes, and appurtenances.
- B. Measurement and Payment Procedures
 - 1. Include all costs for testing, required by this Section in the bid prices for manholes, pipe, and appurtenant structures.

PART 2 PRODUCTS

2.01 TESTING EQUIPMENT

- A. Conform to applicable sections of ASTM.
- B. Conform to other applicable industry standards and codes.

PART 3 EXECUTION

3.01 CLEANING

- A. Clean all manholes, pipes, and structures by removing sheeting, bracing, forms, soil sediment, concrete waste, and other debris.
- B. Do not discharge soil sediment or debris to drainage channels or existing storm sewer. Dispose of properly in a waste containment site that is acceptable to the City.

3.02 VISUAL INSPECTION

- A. Examine structures and pipes for:
 - 1. Damage.
 - 2. Indication of displacement of reinforcement, forms, pipes, or bedding.
 - 3. Porous areas or voids.
 - 4. Proper placement of seals, gaskets, and embedments.
 - 5. Visible infiltration.
- B. Verify that structures and pipes are set to true line, grade, and plumb.
- C. Verify structure and pipe dimensions and thickness.
- D. Measure actual inside dimensions of all flexible pipe prior to installation. Use these dimensions when sizing the mandrel should deflection testing be required.

- E. Storm sewer shall be inspected by flashing a light between manholes or by physical passage where space permits.
 - 1. Lamping shall be done after pipe trench backfill is compacted and brought to grade or pavement subgrade.
 - 2. Full pipe diameter (“full moon”) shall be visible for grade alignment.
 - 3. No less than half pipe diameter (“half moon”) shall be visible for horizontal alignment.

- F. The Contractor shall be responsible to video record the entire newly installed storm sewer system at least 30 days after completion of backfill and one month before the City gives final acceptance for the two-year warranty. The recording shall be made using a color camera, self-propelled or other, having sufficient light to show detail of problem areas and joints. Camera speed shall not exceed 3 feet per second. If problems or concerns are seen by the operator, then the camera shall be reversed and an extended look at the area will be recorded. All recordings will have time, date, and footage displayed. Supplement the video recording with a written log or orally recorded tape log noting observations, findings, and deficiencies shown on the video tape.
 - 1. The video recording inspection shall be performed by an outside independent testing agency acceptable to the City.
 - 2. The video tape and log will be given to the Inspector for review. If the City finds any problems with the storm sewer, the Contractor will repair the problem and re-camera that area before final acceptance will be approved at no added cost to the City.
 - 3. Video recording of storm sewer may be waived if pipe diameter is sufficient for man access, as determined by the Inspector, but a log shall be developed.
 - 4. One copy of the video tape and log will become permanent City property and record.

3.03 MANHOLE TESTING

- A. The finished manholes are expected to be as watertight as the pipe system in which it is incorporated.
- B. Observed leaks (infiltration or exfiltration) at any time within the warranty period shall be cause for rejection.

3.04 STORM SEWER PIPELINE AIR TESTING

- A. If, after the visual inspection and video recording of the storm trunk or lateral lines, the Inspector finds that there is a potential joint tightness problem, or excessive deflection, he/she may require air testing of the line.
 - 1. A test section shall not be any longer than the length of pipe between adjacent manholes. Air testing applies to only circular pipe and not elliptical, arch or box sections.
 - 2. Reference ASTM C1214, latest revision.
 - 3. The low-pressure air test shall occur at least 30 days after completion of the backfilling and compaction.

- 4. If the Inspector determines that reliable and uniform results are produced by the Contractor's construction techniques, the air test may occur after initial backfill and compaction.
- B. The Contractor shall provide all equipment and personnel to perform the tests.
- C. The Inspector shall record times and pressure and vacuum readings during the test period.
- D. Pressure testing may be waived in lieu of individual joint testing.
- E. The ends of the storm sewer pipe being tested shall be plugged and braced.
 - 1. It is recommended that the inside of the pipe be wetted prior to testing.
- F. The length of pipe being tested shall be pressurized to 4.0 psi, allow the air to stabilize, then drop pressure to 3.5 psi.
- G. The pressure pump shall be turned off and the time monitored.
- H. The pressure must not drop more than 1 psi, for the amount of time indicated by using the following formula:

$$T = \frac{LD^2 .00037 D^2 \times L}{Q}$$

- where T = time of test (in seconds),
- L = length of pipe (in feet),
- D = diameter of pipe (in inches).
- Q = allowable air loss (see chart)

Pipe Diameter (Inches)	Test Duration (Minutes per 100 lf)	Q (FT ³)
18	2.4	5
21	3.0	5.5
24	3.6	6
27	4.0	6.8
30	4.4	7.5
33	4.9	8.3
36	5.3	9
42	6.2	10.5
48	7.1	12
54	8.0	15
60	8.9	13.5
66	9.8	16.5
72	10.7	18

- I. Sections of the pipe which fail the air test, shall have the defects repaired, and the test shall be repeated.
 - 1. The initial air testing, repair and repeat testing of the failed section of pipe shall be repeated at no added cost to the City until the testing requirements are met.

3.05 DEFLECTION TEST - FLEXIBLE PIPE

- A. If after the visual or video inspection of the storm trunk or lateral lines, the Inspector finds that there is “egging or deflection” of a section of pipe, a deflection test shall be performed on that section of pipe installed. Test shall be

performed using an odd-legged mandrel pulled through the pipe without mechanical assistance or by laser profiling. The mandrel size shall be the actual inside diameter of the subject pipe (manufacturer's submittal, field verified) minus 5% of that diameter. The mandrel shall have no less than nine legs.

- B. Any pipe failing any deflection test shall be removed, replaced, and retested.
- C. At the end of the two-year warranty period, the flexible storm pipe will be visually inspected for "egging or deflection". If excess deflection is observed, the Owner/Warranty Holder will, at his/her expense, retest questionable portions per this section.

3.06 REPAIR

- A. Repair or replace any unacceptable work at no additional cost to the City.
- B. Repair all visible leaks.
- C. Remove any concrete webs or protrusions.
- D. Remove form ties and repair tie holes.

END OF SECTION