

DPW SANITARY SEWER AND MANHOLE INSPECTION AND TESTING REQUIREMENTS

SANITARY SEWER

Inspection and Testing - Upon completion of the installation and backfilling portions of the sanitary sewer, the pipe shall be inspected by one of several of the methods subsequently described. This inspection and testing shall be undertaken as the work progresses. The Engineer shall be notified in advance of such inspection and testing and the Contractor shall provide all facilities, materials, equipment and labor required for such testing. Such inspection and testing shall be a prerequisite for acceptance of all work.

a.) Visual Inspection - An inspection of the interior of the completed sanitary sewer pipe by direct visual inspection shall be made for all pipe installed from manhole to manhole. Any light, equipment or labor necessary for such inspection shall be provided by the Contractor.

Any foreign material found in the interior of the sewer, any dirt, debris or other objects shall be removed by the Contractor. Visible defects such as broken pipe sections, improperly installed gaskets, projecting connections, cracks, visible leaks or other defects shall be noted, corrected and the pipe re-inspected.

b.) Testing - Such as air testing shall be used by the Contractor. However, any alternate testing method shall be field tested as directed by the Engineer, upon that reach of sewer previously tested as specified hereinbefore. Only after such comparison tests are conducted successfully will the Engineer approve the proposed alternate testing method.

Deflection Test

1) A vertical ring deflection test shall be performed on all newly installed PVC pipe at least one month from construction and flushing of the new sanitary sewer. This test shall be performed using a deflectometer consisting of a rigid mandrel ("Go, No-Go") device, cylindrical in shape with evenly spaced arms/prongs to be hand pulled through all sections of sanitary sewer lines to be tested. The mandrel's arms/prongs shall be no less than 5% the diameter of the pipe being tested. The Contractor shall submit working drawings of the mandrel to the Engineer for each pipe diameter requiring a test. If at any point during the test the mandrel cannot pass any section of the sanitary sewer the pipe shall be uncovered, the deflection corrected, and backfilled completely at no additional cost to the City of Norwalk.

Infiltration Test

1) In areas where there is groundwater during construction, or a segment of pipe is within the measured ground water table the Contractor shall perform the following infiltration test prior to/if there are no lateral connections. The upstream end shall be plugged. If infiltration is present the Contractor will be required to investigate and eliminate the infiltration. The allowable infiltration shall not exceed a rate of 50 gallons per mile, per inch of sewer diameter per 24 hours.

Force Main Testing

- 1) All force mains shall be tested in accordance with the latest revision of the Hydrostatic Testing Requirements from AWWA C600, "Installation of Ductile-Iron Mains and Their Appurtenances".

Procedure for Air Pressure Testing Sanitary Sewer Pipe

All gravity sewers shall be tested in the procedure described within this section and within their applicable ASTM standard.

- a. Concrete Pipe (RCP) sewer lines shall follow the latest revision of ASTM C 924, Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
 - b. PVC Pipe (PVC) sewer lines shall follow the latest revision of ASTM F 1417, Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
 - c. Vitrified Clay Pipe (VCP) sewer lines shall follow the latest revision of ASTM C 828, Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
 - d. All Cast Iron Pipe (CI) and Ductile Iron Pipe (DI or DIP) gravity sewer lines shall be tested using the latest revision of ASTM F 1471, Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
- 1.) Test is conducted between two (2) consecutive manholes, as directed by the Engineer.
 - 2.) The test section of the sewer line is plugged at each end. One of the plugs used at the manhole must be tapped and equipped for the air inlet connection for filling the line from the air compressor.
 - 3.) All service laterals, stubs and fittings into the sewer test section should be properly capped or plugged, and carefully braced against the internal pressure to prevent air leakage by slippage and blowouts.
 - 4.) Connect air hole to tapped plug selected for the air inlet. Then connect the other end of the air hose to the portable air control equipment which consists of valves and pressure gages used to control:
 1. The air entry rate to the sewer test section.
 2. To monitor the air pressure in the pipe line.

More specifically, the air control equipment includes a shut-off valve, pressure regulating valve, pressure reduction valve and a monitoring pressure gage having a pressure range from 0 to 5 psi. The gage should have minimum divisions of 0.10 psi and an accuracy of ± 0.04 psi.
 - 5.) Connect another air hose between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment set-up and the test operations may commence.
 - 6.) Supply air to the test section slowly, filling the pipe line until a constant pressure of 3.5 psig is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig.
 - 7.) When constant pressure of 3.5 psig is reached, throttle the air supply to maintain the internal pressure above 3.0 psig for at least 5 minutes. This time permits the temperature of the entering air to

equalize with the temperature of the pipe wall. During this stabilization period, it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections.

If leakage is detected at any cap or plug, release the pressure in the line and tighten all leaky caps and plugs. Then start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new 5-minute interval must be allowed after the pipe line has been refilled.

8.) After the stabilization period, adjust the air pressure to 3.5 psig and shut off or disconnect the air supply. Observe the gage until the air pressure reaches 3.0 psig. At 3.0 psig, commence timing with a stop watch which is allowed to run until the line pressure drops to 2.5 psig at which time the stop watch is stopped. The time required as shown on the stop watch for a pressure loss of 0.5 psig is used to compute the air loss.

9.) If the time, in minutes and seconds, for the air pressure to drop from 3.0 to 2.5 psig is greater than that in Table 1 below for the designated pipe size, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued at that time.

10.) If the time, in minutes and seconds, for the 0.5 psig drop is less than that shown in Table 1 below for the designated pipe size, the section of pipe shall not have passed the test; therefore, adequate repairs must be made and the line retested.

1. Pipe sizes with their respective Recommended Minimum Times, in Minutes and Seconds, for Acceptance by the Air Test Method.
2. For eight (8) inch and smaller pipe, only: if, during the 5-minute saturation period, pressure drops less than 0.5 psig after the initial pressurization and air is not added, the pipe section undergoing tests shall have passed.
3. Multi Pipe Sizes: When the sewer line undergoing test is 8" or larger diameter pipe and includes 4" or 6" laterals, the figures in Table 1 below for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multi-pipe sizes are to undergo the air test, the engineer can compute the "average" size in inches which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 psig for the "average" diameter pipe.

TABLE 1

Time Requirements For Air Testing

PIPE SIZE (INCHES)	TIME	
	MIN.	SEC.
4	2	32

6	3	50
8	5	06
10	6	22
12	7	39
14	8	56
15	9	35
16	10	12
18	11	34
20	12	45
21	13	30

(For larger diameter pipe use the following: Minimum time in seconds = 462 x pipe diameter in ft.)

d.) Inspection by Closed Circuit TV Camera - Shall be made on the completely installed, backfilled and Infiltration/exfiltration tested sanitary sewers, and shall be required for final acceptance.

Inspection shall be performed by a NASSCO Pipeline Assessment Certification Program (PACP) certified operator and shall meet the coding and reporting standards and guidelines as set by PACP. All report annotations, pipe conditions and pipe defects shall be documented in accordance with PACP guidelines.

The Contractor shall use the current industry standards for their video camera and production formatting.

The Contractor shall submit the final product with the current industry standard operating software that is able to be used by the City of Norwalk.

General Reporting Requirements:

- Audio shall be free from electrical interference and background noise to clearly identify the oral report.
- Each segment (manhole to manhole) shall have the following information clearly identified when finalized and within each video: Project title, City of Norwalk by name, time of day, map number, manhole to manhole pipe section, pipe material, sewer diameter and length, compass direction of viewing, direction of camera's travel, pipe depth, and operator's name.
- The speed of travel shall be no faster than 30 feet per minute.
- An accurate distance gauge (feet) shall be shown during the inspection to clearly identify important features in the sanitary sewer.

- Each joint or any abnormal feature shall be stopped at and inspected with a pan and tilt when appropriate.
- Every lateral connection should be stopped at and viewed with a pan and tilt viewing as far into the lateral as possible.
- All manholes shall be panned with the video camera and visually inspected.
- All important features shall be identified by audio and on the PACP log.

Major Test by Sections - After any such section has been tested, the Engineer may, at his discretion, permit capped connections to be made with this section of sewers by other parties; said sections may not be put in service until all sewers contemplated under this Contract have been completed and tested unless specifically waived by the City.

MANHOLE

1. General:

1. After the gravity sewers and manholes have been installed and backfilled, the manholes shall be tested for leakage.
2. The Contractor may select water testing or vacuum testing as specified below. However, the City holds the right that the Engineer can direct to use the Vacuum Test if the test and results for the Water Test are not satisfactory.

2. Test Procedure (Utilizing a Vacuum Test):

1. All lines entering and leaving each manhole shall be plugged and plugs securely braced to prevent the vacuum from pulling the plugs out of the pipe. The vacuum test shall be performed after the manhole frame and cover are installed. Lift holes shall be plugged with a non-shrinking mortar. Provide all the necessary hardware to perform the vacuum test as manufactured by NPC systems, Inc., Milford, NH or approved equals. With the vacuum testing equipment in place proceed with the following:
 1. Inflate the compression band to effect a seal between the vacuum base and the manhole.
 2. Connect the vacuum pump to the outlet port with the valve open.
 3. Draw a vacuum of 10 inches of Hg.
 4. Close the valve.

2. A manhole will be considered acceptable if it takes more than 60 seconds for a 48-inch, 75 seconds for a 60-inch and 90 seconds for a 72-inch diameter manhole for the vacuum to drop from 10-inch of Hg to 9-inch of Hg. regardless of depth.

The Vacuum test shall follow the procedure currently depicted in this section as well as fulfill the requirements set forth in ASTM C1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

3. Alternate Test Procedure (Utilizing Water)

1. All sewers entering and leaving each manhole shall be plugged. Those manholes which are constructed in a high ground water table location shall be allowed to remain plugged for a period of not less than four (4) hours, after which the quantity of inward leakage accumulation shall be measured by bailing and measuring and/or computation against depth of water and diameter of the manhole. Those manholes constructed above the ground water table shall be filled with water to the top of the cast iron frame and allowed to stand until the walls are well soaked. The manhole shall then be refilled to the full or overflow point and remain undisturbed for a period of not less than four (4) hours. The loss of water shall be measured by refilling to the top with a pre-measured quantity of water and/or computation against depth of water loss and diameter of the manhole.

2. Gain or loss by the respective methods shall not exceed the following:

1. 0.02 gal. per hour, per vertical ft. of depth in top section.
2. 0.03 gal. per hour, per vertical ft. of depth in a cone section.
3. 0.04 gal. per hour, per vertical ft. of depth in a 4 foot diameter barrel section.
4. 0.05 gal. per hour, per vertical ft. of depth in a 5 foot diameter barrel section.

5. 0.06 gal. per hour, per vertical ft. of depth in a 6 foot diameter barrel section.
6. 0.07 gal. per hour, per vertical ft. of depth in a 7 foot diameter barrel section.
7. 0.08 gal. per hour, per vertical ft. of depth in a 8 foot diameter barrel section.

If the test results for any manhole are unacceptable, regardless of the type of testing method that is used, the manhole shall be deemed as having failed the test. After adequate repairs have been made to the manhole, it shall be retested. This process shall be repeated until the test results are acceptable. Once the Contractor has chosen the type of testing method that will be used, that particular type of testing will be used for the entire project unless otherwise approved by the Engineer. The Contractor shall submit a statement indicating the type of testing method that will be used with the Shop Drawing submittal package. There will be no interchanging of testing methods to try to obtain favorable results by using one testing method over another testing method on the project, without the prior approval of the Engineer.