

SECTION 4 – TESTING

1. GENERAL

Testing and inspection of the completed work shall be accomplished by the following methods:

1. Visual Inspection
2. Infiltration Testing (Leakage Tests)
3. Air Pressure Testing of Lines
4. Roundness Testing
5. Vacuum Testing of Manholes
6. Gravity Sewer Video Inspection

Upon completion of construction the Contractor shall remove all sand, dirt, brick and other foreign materials from the sewers and shall conduct his own inspection to locate any defects and determine when the sewers are ready for testing and final inspection by the Engineer and the Engineering Department. All apparent defects shall be corrected by the Contractor before testing or final inspection are requested.

No sewer line shall be allowed to discharge into the existing sewage system until said line is free of foreign materials and obvious defects have been corrected. New lines, then, must remain disconnected from the existing system by actual physical separation, by plugs of type approved by the Engineering Department, or by other means approved by the Engineering Department.

Testing of the system before final inspection by the Engineering Department shall consist of visual observation and leakage tests conducted by the Engineer and observed by the Engineering Department. The Engineering Department will not conduct a final inspection until receiving written notification from the Engineer that the construction is complete in accordance with approved drawings and specifications. This notification shall include a report of the results of the visual observation and leakage tests.

2. VISUAL INSPECTION

The Engineer will make the necessary visual inspections to verify the quality of workmanship. Such inspections shall include examination of manholes, “lamping”, “flashing” or “televising” sewer lines and observation of clean-up, pavement replacement.

Any defects such as misalignment of sewers, visible leaks, obstructions, cracked or broken pipe, or failure to restore the surface to a satisfactory condition must be corrected before acceptance.

3. LEAKAGE TESTS

In addition to the visual inspections, leakage tests may be made to insure compliance with the infiltration limitations. Infiltration shall not exceed 25 GPD per inch diameter per mile of sewer. However, in view of the fact that the ground water table fluctuates and likely will not be at a maximum when the test needs to be made, tests may be based on

exfiltration with a head of one foot above the invert at the upstream manhole. Time and method for any exfiltration test must be approved by the Engineering Department before running the test. Exfiltration tests shall have a duration of one hour and the permissible limits for exfiltration shall be 50 gallons per day per inch diameter per mile of sewer. Water required for the exfiltration test must be furnished by the Contractor.

4. AIR PRESSURE TEST

Air pressure tests shall be required for all lines. Equipment shall be top quality, in good condition, and approved by Engineer for use on this project. Plugs should have a sealing length equal to or greater than the diameter of pipe being tested. External bracing of the plugs should not be required in order for the plug to hold against internal air pressure. The test equipment shall include accurate pressure gages to monitor test pressure, safety relief valve(s), and quick-release air bleed valve(s).

- a) The procedure for air pressure testing shall conform to ASTM C828, unless modified herein.
- b) After backfilling and cleaning the line (including flushing, if necessary) making sure all service plugs are adequately braced against internal pipe pressure, and checking air test equipment including pipe plugs (suitably braced against internal pipe pressure, if necessary), the sewer line section to be tested shall be pressurized to 4 psig (pounds per square inch-gage) greater than the average back pressure of any ground water that may be over the pipe (2.31 feet of water – 1 psig). At least 2 minutes shall be allowed for air pressure to stabilize. After the stabilization period and with 3.5 psig minimum pressure in pipeline, air supply shall be disconnected and the time observed which results in a 1 psig pressure drop.
- c) The portion of line being tested shall be termed “Acceptable” if the time required for the pressure to decrease from 3.5 psig to 2.5 psig (greater than average back pressure of any ground water over pipe) is not less than that stated in the following table:

PIPE DIAMETER <u>Inches</u>	TIME <u>Minutes</u>	LENGTH* <u>Feet</u>
8	4.2	350
10	4.7	275
12	5.7	225
15	7.0	175
18	8.5	150
21	9.9	125
24**	11.3	125

*Shorter or longer test length shall have test time modified in accordance with Engineer’s decision.

**Air test will not be run on pipe larger than 24” diameter.

- d) If the pipe is tested in a “dry” condition and fails to meet the test, specifications allow for the pipe to be wetted and tested in that condition. Initial testing may be in the “dry” or “wet” condition at the Contractor’s option.
- e) Observe safety precautions during test. Caution all workers to remain clear of test plugs, which can blow out under considerable force at any time the line is pressurized.

Tests shall be made upon completion of the sewer after visual inspection but before any service connections have been made. The Developer through his Contractor or Engineer shall furnish all labor, tools, equipment and materials for the tests. The tests must be scheduled at a time acceptable to the Engineering Department and shall be witnessed by the Engineer’s representative.

5. ROUNDNESS TEST

Sewer constructed of PVC pipe shall pass a go/no-go mandrel sized to 95% of the actual pipe diameter with the pipe in place and backfill completed.

Contractor shall provide a suitable ball or mandrel having a diameter equal to 95% of the actual inside pipe while the Owner or his authorized representative observes the test. Any section of sewer showing a deflection of more than 5% of the actual inside diameter shall be considered to have failed and shall be re-laid to correct the condition. Mandrel shall be pulled without mechanical pulling devices and shall not be performed until a minimum of 7 days after backfilling operations.

6. VACUUM TESTING OF MANHOLES

Before final acceptance all manholes shall be vacuum tested to at least 10” hg. The test shall be considered acceptable when the vacuum remains at 10” Hg. or drops to no less than 9” Hg. within a one (1) minute period. In the event the manhole fails, the test shall be repeated and repairs made to the manhole until satisfactory results are acquired.

Before making any new connections to an existing manhole, the contractor is required to perform a vacuum test on the manhole using the same guidelines mentioned above.

The Developer, through his Contractor or Engineer, shall furnish all labor, tools, equipment, materials, apparatus, gauges, etc. for the tests.

7. GRAVITY SEWER VIDEO INSPECTION

Approximately six (6) months after the start date of the warranty period, the City of Lebanon and/or a third party contracted by the City of Lebanon will conduct a video inspection and log of the gravity sewer main. The City of Lebanon reserves the right to re-inspect the lines at any time during the warranty period and will not accept any defects discovered during that period. Any defects in workmanship or materials, including settlement, detected in any video inspection shall be corrected to the satisfaction of the City of Lebanon Engineering and Sewer Departments. The cost of the initial video inspection shall be included in the existing Gravity Sewer Inspection Fee listed in Section 1 of these specifications.

Should repairs be required, the City of Lebanon may, at its discretion, require a video re-inspection of the repaired line. If so, the owner/developer shall be charged a setup fee in the amount of \$175.00 plus \$1.00 per linear foot of pipe inspected, including travel distance to and through the repair area and through to the next junction or manhole, if necessary. The owner/developer shall be informed of this amount by the City Engineering Department and the specified amount shall be paid in full before the re-inspection will be scheduled. The owner/developer or designated contractor shall request the inspection/re-inspection at least one week in advance and the City Sewer Inspector will then coordinate the best available time based upon availability of City resources and personnel. The City reserves the right to cancel or reschedule the inspection/re-inspection should an emergency require those same resources. If it is necessary to clean the line before any inspection, initial or follow-up, a \$230.00 per hour rate will be charged to the owner/developer. This fee will be paid in full before the sewer system is accepted by the City of Lebanon. The flooding and flushing of lines will be performed by others prior to the video inspection.

8. TESTING FORCE MAINS

Before final acceptance force mains shall be pressure tested by suitably closing the end of the main with a test plug of approved design suitably braced against the internal pressure to prevent blowout and possible injury to personnel. Contractor shall furnish all labor, materials and equipment for testing the force main including but not limited to water for testing, test pump, pressure gauges, test plugs, etc. Test shall be performed by Contractor and witnessed by the Owner or his authorized representative.

The force main shall be filled with water taking care to eliminate air from the high points. A positive displacement test pump shall be used to pump clean water into the main to build up a test pressure equal to the normal system pressure plus 50 psi. Test pressure will be determined by the Engineer. The test pump shall then be valved off from the system and the pressure shall be observed over a period of one hour. A drop in pressure of 5 psi or more during the one hour test period shall be taken as an indication of leakage. In the event leaks are found and corrected, the Contractor shall repeat the pressure test using the same procedure described above. Should the Contractor be unable to obtain a satisfactory pressure test over a duration of one hour, he shall then be required to perform a leakage test using a water tap and standard water meter to measure the leakage in the test section at system pressure over a period of 24 hours. Leakage during the 24 hour period must not exceed the allowable leakage for mechanical or push-on joints as shown in AWWA C600, latest revision. Leakage shall not exceed the quantity determined for the formula: $L = N \times D \times P - 1/2$ divided by 3750 where L is allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is nominal pipe diameter in inches; and P is the average test pressure during the leakage test, in pounds per square inch.

Should the system fail to pass the leakage test the Contractor will be required to locate and correct the leaks and to retest the system until satisfactory results can be obtained.

The Contractor shall provide suitable first quality pressure gauges with 5lb. or smaller graduations and a standard $3/4"$ x $5/8"$ water meter in the event the meter is required for the

leakage test. Pressure gauges and water meter shall be in good condition and shall be subject to such tests for proof of accuracy as the Owner or his authorized representative.

9. TESTING OF VALVES

Upon completion of the work, the Contractor/Developer shall operate all buried valves in the presence of the Engineer/Engineering Department Representative to verify proper operation of each valve.

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