

## **Acceptance Testing Section 800**

### **810 General Requirements**

810.01 Acceptance testing criteria are the minimum requirements to be used within the jurisdiction of the City of Burnet. The jurisdiction of the City of Burnet is defined as the area bound by the ETJ of the City of Burnet. This includes any private system which will connect or which may connect to City utilities.

810.02 Calibration of all gauges pressure or vacuum gauges shall have a sticker affixed upon the gauge certifying it has been calibrated within the preceding six months before the equipment is allowed to be used for acceptance testing.

810.03 The Contractor will not be permitted to load the new piping by opening a valve connected to an existing system. The Contractor may use an existing service or install a new service in the existing main. The connection shall be installed with a mechanical backflow prevention device and shall be metered.

### **820 Water Main Testing**

#### **821 Acceptance Testing of Water Main**

821.01 Laboratory Testing of Backfill – Backfill must meet the requirements as set forth in Section 600 and as shown in the standard details. During construction the backfill for water mains must be compacted to 95-100% Standard Proctor (ASTM D-698) and field density tests must be taken and compared to the corresponding proctor horizontally every 100 linear feet at a vertical depth of 2-ft. Backfill with too much moisture that, upon a visual inspection, shows pumping will be rejected and require drying and reworking. Backfill that fails a density test must be recompacted for a length and depth specified by the inspector and retested. All tests must be done in the presence and under the direction of a city inspector. Copies of all tests must be forwarded to the City Engineer or his designated representative within two weeks of the test date. The City Engineer or a city inspector may require testing at intervals greater than described if needed.

821.02 Hydrostatic Testing: After the pipe has been installed and backfilled and all service laterals, fire hydrants and other appurtenances installed and connected, a pressure test, followed by a leakage test, shall be conducted by the Contractor and witnessed by a City of Burnet Inspector. The use of a reduced pressure zone (RPZ) backflow prevention device shall be used when loading the water main (see Water details, Section 380). The Contractor will furnish all the equipment required for the tests. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points.

All water services and fire hydrant leads, with the main 6-inch gate valve open, the hydrant valve seats closed and nozzle caps open, shall be included in the test.

- A. Pressure Test: New mains shall be hydrostatically field tested before acceptance by being placed under 1.5 times system pressure, (or 175 psi) for a period of not less than 24 hours. It is the intent of these specifications that all joints be watertight and that all joints which are found to leak either by observation or during any test shall be made watertight by the Contractor. Repairs shall be made by the Contractor to correct any leaking or defective materials.

- B. Pressure Pipe Leakage Test: A leakage test will follow the pressure test and be conducted on lengths not to exceed 1000 feet or each valved section. The leakage test shall be at 150 psi for at least 2 hours and not to exceed 6 hours.
- C. Allowable Leakage: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time. Allowable leakage shall be defined as any leakage under the following formula:

$$L = SD(P)^{1/2} / 133,200$$

Where:

- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the leakage test, in psig

If repairs are required, the hydrostatic field test shall be repeated until the pipe installation conforms to the specified requirements and is acceptable by the City Engineer.

- D. Location and Correction of Leakage: If such testing discloses leakage in excess of this specified allowable, the Contractor, at his expense, shall locate and correct all defects in the pipe line until the leakage is within the indicated allowance.

All visible leakage in pipe shall also be corrected by Contractor at his own expense.

- E. Operation of valves: No valve in the City's water distribution system shall be operated by the Contractor without prior authorization by the City. The Contractor shall notify the City when a valve is to be operated and shall operate the valve only in the presence of the City's representative.

821.03 Disinfection of Potable Water Lines: The Contractor shall protect all piping materials from contamination during storage, handling and installation. Prior to disinfection, the pipeline interior shall be clean, dry and unobstructed. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work.

Water for the work shall be metered and furnished by the Contractor. However, fees for water usage will be waived on Capital Improvement Projects.

The Contractor, at his expense, will supply the test gauges and the Sodium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 5 percent to fifteen percent available chlorine. Calcium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 65 percent available chlorine by weight, may be used in granular form or in 5 g tablets for 16" diameter or smaller lines.

During construction, granules or tablets shall be placed in the pipe for disinfection. Water mains and appurtenances must be completely installed, flushed, disinfected, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system.

- A. Procedure and Dosage: Connection to the existing system will be allowed with a valve arranged to prevent the strong disinfecting dosage from flowing back into the existing water supply piping. The valve shall be kept closed. No other connection shall be made until the disinfection of the new line is complete and the water samples have met the established criteria. The valve shall remain closed at all times. The new pipeline shall not be filled by opening the valve to the existing system. The new pipeline shall be filled completely by using an existing service or by installing a new service. Regardless of the method used, a backflow prevention device shall be installed. Every part of the line shall contain a minimum concentration of 50 ppm available chlorine.

The disinfecting solution shall be retained in the piping for at least 24 hours and all valves, hydrants, services, stubs, etc. shall be operated so as to disinfect all their parts. After this retention period, the water shall contain no less than 25 parts per million chlorine throughout the treated section of the pipeline.

The heavily chlorinated water shall then be carefully flushed from the potable water line until the chlorine concentration is no higher than the residual generally prevailing in the existing distribution system or approximately one part per million. Proper planning and appropriate preparations in handling, diluting, if necessary, and disposing of this strong chlorine solution is necessary to insure that there is no injury or damage to the public, the water system or the environment. Additionally an authorized representative of the City must witness the flushing.

Approval for discharge of the diluted chlorine water or heavily chlorinated water into the wastewater system must be obtained from the Water and Wastewater Utility Department. The line flushing operations shall be regulated by the Contractor so as not to overload the wastewater system or cause damage to the odor feed systems at the lift stations.

- B. Bacteriological Testing: After final flushing of the strong disinfecting solution, water samples from the line will be tested for bacteriological quality by the City and must be found free of coliform organisms before the pipeline may be placed in service. One test sample will be drawn from the end of the main and additional samples will be collected at intervals of not more than 1000 feet along the pipeline. All stubs shall be tested before connections are made to existing systems.

The Contractor, at its expense, shall install sufficient sampling taps at proper locations along the pipeline. Each sampling tap shall consist of a standard corporation cock installed in the line and extended with a copper tubing gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

Samples for bacteriological analysis will only be collected from suitable sampling taps in sterile bottles treated with sodium thiosulfate. Samples shall not be drawn from hoses, fire hydrants or unregulated sources. The City, at its expense, will furnish the sterile sample bottles and collect the test samples. Testing fees will be paid by the Contractor at the time of sampling.

If the initial disinfection fails to produce acceptable sample test results, the disinfection procedure shall be repeated. Before the piping may be placed in service, satisfactory test results must be obtained.

An acceptable test sample is one in which: (1) the chlorine level is similar to the level of the existing distribution system; (2) there is no free chlorine and (3) the total coliform count is zero. An invalid sample is one, which has excessive free chlorine, silt or non-coliform growth. If invalid sample results are obtained for any pipe, the Contractor may, with the concurrence of the Inspector, flush the lines and then collect a second series of test samples for testing by the City. After this flushing sequence is completed, any pipe with one or more failed samples must be disinfected again in accordance with the approved disinfection procedure followed by appropriate sampling and testing of the water.

The City of Burnet Laboratory will notify the assigned City of Burnet Inspector in writing of all test results. The Inspector will subsequently notify the Contractor of all test results. The Laboratory will not release test results directly to the Contractor.

### **830 Wastewater Testing**

#### **831 Acceptance Testing of Wastewater Manholes**

Manholes shall be tested separately and independently of the wastewater lines.

**831.01 Vacuum Method:** A pre-vacuum test shall be performed by the Contractor after assembly and prior to backfilling. A vacuum test will be performed after backfill and base installation.

All lift holes and exterior joints shall be plugged with a non-shrink grout prior to backfilling. No grout shall be placed in horizontal joints prior to testing.

Testing after backfill and compaction are complete will be the basis for acceptance of the manhole.

##### **A. Equipment:**

1. **Plug Design:** Pneumatic plugs shall be used. All plugs shall be designed to resist internal testing pressures without the aid of external bracing or blocking.
2. **Singular Control Panel:** To facilitate test verification by the Inspector, all air used shall pass through a single, above ground control panel.
3. **Equipment Controls:** The above ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge and a continuous monitoring pressure gauge having a pressure range from 0 to at least 10 psi. The continuous monitoring gauge shall be no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of +/-0.04 psi.
4. **Separate Hoses:** Two separate hoses shall be used to: (1) connect the control panel to the sealed line for introducing low-pressure air, and (2) a separate hose connection for constant monitoring of air pressure build up in the line. This requirement greatly diminishes any chance for over pressuring the line. A separate hose shall also be required to inflate the pneumatic plugs from the above ground control panel.

B. Procedures:

1. Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints prior to testing.
2. After cleaning the interior surfaces of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer. Plugs and the ends of pipes connected by flexible boots shall be blocked to prevent their movement during the vacuum test.
3. The vacuum test head shall be placed on the top of the cone section or, inside of the top of the manhole cone section, and the compression seal band inflated to the pressure recommended by its manufacturer. The vacuum pump shall be connected to the outlet port with the valve open. When a vacuum of 10 inches of mercury has been attained, the valve shall be closed and the time noted. Tampering with the test equipment will not be allowed. Vacuum gauges shall not show evidence of sticking, and gauge that shows evidence of sticking shall be replaced with a calibrated gauge prior to any additional testing.
4. The manhole shall have passed the test if the vacuum does not drop below 9 inches of mercury within 2 minutes. The actual vacuum shall be recorded at the end of the test time minutes during which the valve was closed.
5. When the standard vacuum test cannot be performed because of design or material, testing shall be performed as directed by the City Engineer.

831.02 Smoke Testing: All rings and covers shall be smoke tested by the contractor upon completion of project and prior to final acceptance. Any defects shall be repaired.

831.03 Failure to Pass the Test -- Records of Tests: If the manhole fails to pass the initial test method as described in (1) Test by the Vacuum Method, the Contractor shall locate the leak, if necessary by disassembly of the manhole, checking gaskets and replacing if necessary, re-lubrication and re-assembly, or Contractor may install an acceptable exterior joint sealing product on all joints and then retested. If any manhole fails the vacuum twice, the Contractor shall consider replacing that manhole. If the Contractor chooses to attempt to repair that manhole, the manhole must be retested until it passes. In no case shall cold applied preformed plastic gaskets be used for repair. Records of all manhole repairs/testing shall be made available to the City Engineer prior to acceptance. Any damaged or visually defective products, or any products out of acceptable tolerance shall be removed from the site.

At a minimum, test records on all manholes that fail, shall include the following and shall be part of the project records turned in with the acceptance package.

Name of the manhole manufacturer  
Date tested/date re-tested  
Passed/failed and state what was done to correct the problem  
Test Method Used

Location/station of manhole  
Precast/cast-in- place bottom  
Type of Coating  
Any repairs made to the joints.

831.04 Inspection: The City Engineer Representative shall make a visual inspection of each manhole after it has passed the testing requirements and is considered to be in its final condition. The inspection shall determine the completeness of the manhole; any defects shall be corrected to the City Engineer satisfaction.

The City Engineer Representative may, at any time, require a calibration check of the instrumentation used. The Vacuum gauge shall have a calibration sticker within the last six (6) months.

### 832 **Quality Testing for Installed Pipe**

832.01 Laboratory Testing of Backfill – Backfill must meet the requirements as set forth in Section 600 and as shown in the standard details. During construction the backfill for sewer mains must be compacted to 95-100% Standard Proctor (ASTM D-698) for 4-10 feet of cover or 95-100% of Modified Proctor (ASTM D-1557) for more than 10 feet of cover and density tests must be taken and compared to the corresponding proctor horizontally every 100 linear feet and vertically at the following depths (depending on depth of sewer main): 2 ft, 5 ft, 7.5 ft, 10 ft, 12.5 ft. Backfill that fails a density test must be recompacted for a length and depth specified by the inspector and retested. In addition, where Moisture Sensitive Material is used as backfill (See Section 600 and standard details) the material must be within 3% (+ or -) of the optimum moisture content for the respective proctor, otherwise it will be wetted (or dried) and reworked as necessary. Backfill with too much moisture that, upon a visual inspection, shows pumping will be rejected and require drying and reworking. All tests must be done in the presence and under the direction of a city inspector. Copies of all tests must be forwarded to the City Engineer or his designated representative within two weeks of the test date. The City Engineer or a city inspector may require testing at intervals greater than described if needed.

### 832.02 Low Pressure Air Test of Plastic Gravity Flow Wastewater Lines:

- A. General: Wastewater lines shall be air tested between manholes. Backfilling to grade shall be completed before the test and all laterals and stubs shall be capped or plugged by the Contractor so as not to allow air losses, which could cause an erroneous, test result. Manholes shall be plugged so they are isolated from the pipe and cannot be included in the test.

All plugs used to close the sewer for the air test shall be capable of resisting the internal pressures and must be securely braced. Place all air testing equipment above ground and allow no one to enter a manhole or trench where a plugged sewer is under pressure. Release all pressure before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the sewer under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. Use care to avoid the flooding of the air inlet by infiltrated ground water. (Inject the air at the upper plug if possible.) Use only qualified personnel to conduct the test.

- B. Ground Water: During construction any ground water shall be noted on the approved construction drawings.

If ground water is noted during construction, test holes shall be dug to the pipe

zone at intervals of not more than 100 feet and the average height of ground water above the pipe (if any) shall be determined before starting the test.

- C. Test Procedure: The City Engineer may, at any time, require a calibration check of the instrumentation used. Use a pressure gauge having minimum divisions of 0.10 psi. All air used shall pass through a single control panel. Clean the sewer to be tested and remove all debris where indicated. Wet the sewer prior to testing. The average back pressure of any groundwater shall be determined (0.433 psi) for each foot of average water depth (if any) above the sewer.

Add air slowly to the section of sewer being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any ground water that may submerge the pipe. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure. After the temperature stabilization period, disconnect the air supply. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average back pressure of any ground water that may submerge the pipe. Compare the time recorded with the specification time for the size and length of pipe as given in the following table:

**Table For Low Pressure Air Testing of Plastic Pipe:**

Pipe Diameter (Inches)	Minimum Time (Seconds)	Length of Pipe for Minimum Time (Feet)	Time for Longer Length of Pipe (Seconds)
6	340	398	0.855(L)
8	454	298	1.520(L)
10	567	239	2.374(L)
12	680	199	3.419(L)
15	850	159	5.342(L)
18	1020	133	7.693(L)
21	1190	114	10.471(L)
24	1360	100	13.676(L)

The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the test period, then the test shall continue for the entire test duration as outlined above or until failure.

Any drop in pressure, from 3.5 psig to 2.5 psig (adjusted for groundwater level), in a time less than that required by the above table shall be cause for rejection.

Low-pressure air tests must conform to the procedure described in ASTM C-924 or other equivalent procedures.

**832.03 Pressured Sewer/Forced Mains Test:** The use of a reduced pressure zone (RPZ) backflow prevention device shall be used when loading the force main from the city's potable water mains (see Sewer Details, Section 480). Leakage in the pressure sewer hydrostatic test shall be defined as the quantity of water that must be supplied into the pipe

or any valved section thereof, to maintain pressure within 5 pounds per square inch of the specified test pressure after the air in the pipeline has been expelled. The test pressure shall be 50 psi above the normal operating pressure. The minimum test time is 4 hours. The maximum allowable leakage shall not exceed 10 gallons per inch diameter per mile of pipe per day. If the quantity of leakage exceeds the maximum amount calculated, remedial action shall be taken to reduce the leakage to an amount within the allowable limit.

**832.04 Effluent/Reuse Line Pressure Testing:** Shall be performed in accordance with Section 821.01 Hydrostatic Testing of Water Mains. In no case shall the allowable leakage be greater than that specified in the TNRCC Chapter 317.2.

**832.05 Deflection Test:** Deflection tests shall be performed on all flexible pipes. For pipelines with inside diameters less than 27 inches, a rigid mandrel shall be used to measure deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of five percent. If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices.

The design engineer should recognize that this is a maximum deflection criterion for all pipes and a deflection test less than five percent may be more appropriate for specific types and sizes of pipe. Upon completion of construction, the design engineer or other Texas Registered Professional Engineer appointed by the owner shall certify, to the City Engineer, that the entire installation has passed the deflection test. This certification may be made in conjunction with the notice of completion.

Test(s) must be performed without mechanical pulling devices and must be witnessed by the City Engineer or his designated representative.

Any deficiencies noted shall be corrected by the Contractor and the test(s) shall be redone.

The rigid mandrel shall have an outside diameter (O.D.) equal to 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe, all dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

The rigid mandrel shall be constructed of a metal material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 100% of the inside diameter of the pipe.

A proving ring shall be provided and used for each size mandrel in use. Contractor shall submit his proposed pipe mandrels and proving rings to the City Engineer or his designated representative for concurrence prior to testing the line.

**Method Options:**

- a) Adjustable or flexible mandrels are prohibited.
- b) A television inspection is not a substitute for the deflection test.
- c) A deflectometer may be approved for use on a case by case basis.
- d) Mandrels with removable legs or runners will be accepted.



### **833 Wastewater Main Inspection**

**833.1 Description:** The Contractor shall furnish all labor, materials, equipment, and incidentals to provide the televising and videotaping of sewer lines and manholes utilizing a color, closed-circuit television inspection unit to determine their condition.

**833.2 General:** After construction of the sanitary sewer main, the newly constructed sanitary sewer shall be televised immediately upon cleaning and flushing. Any abnormalities such as, but not limited to, misaligned joints, cracked/defective pipe, rolled gaskets, shall be repaired. Sections requiring repair shall be re-televised to verify condition of repair.

**833.3 Execution:** The Contractor shall provide a VHS videotape and logs of the televised inspection for review. The television unit shall also have the capability of displaying in color, on VHS videotape, pipe inspection observations such as pipe defects, sags, points of root intrusion, offset joints, service connection locations, and any other relevant physical attributes. Each tape shall be permanently labeled with the following:

Project name;  
Date of television inspection; Name of City Inspector observing;  
Station to station location and size of sanitary sewer;  
Street/easement location;  
Name of Contractor; Date tape submitted; and  
Tape number.

The Contractor shall provide a line diagram area sketch and written log for each completed segment of videotaped sewer main describing the section being televised, flow and camera direction, position of service connections, description and location of failures, pipe condition, weather conditions, and other significant observations. The television inspection equipment shall have an accurate footage counter which displays on the monitor the exact distance of the camera from the center of the starting manhole. A camera with rotating and panning lens capabilities is required. The camera height shall be centered in the conduit being televised. The speed of the camera through the conduit shall not exceed 40 feet per minute. The Contractor shall be required to have all materials, equipment, and labor force necessary to complete all videotaping on the job site prior to isolating the sewer manhole segment and beginning videotaping operations.

The Contractor shall not be allowed to float the camera. There may be occasions during the televised inspection of a manhole section when the camera will be unable to pass an obstruction. At that time, and prior to proceeding, the Contractor shall contact the Project Inspector. If the length of sewer line cannot be televised because of obstructions, the Contractor shall clean the system as is necessary. If, in the opinion of the Inspector, the obstruction is attributed to a collapsed main or pipe deflection, televising shall be suspended.

### **840 Storm Drainage Pipe Television Inspection**

**840.01 Laboratory Testing of Backfill:** Before construction may begin sample proctors of the soil must be taken by a certified geotechnical lab at each location of the storm drainage pipe where the soil classification changes. During construction the backfill for storm drainage pipe must be compacted to 95-100% Standard Proctor (ASTM D-698) for 4-10 feet of cover or 95-100% of Modified Proctor (ASTM D-1557) for more than 10 feet of cover and density tests must be taken and compared to the corresponding proctor horizontally every 100 linear feet and vertically at the following depths (depending on depth of storm drainage pipe): 2 ft, 5 ft, 7.5 ft, 10 ft, and 12.5 ft. Backfill that fails a density test must be recompacted for a length and depth specified by the inspector and retested. In addition, where Moisture Sensitive Material is used as backfill (See Section 600 and standard details) the material must be within 3% (+ or -) of the optimum moisture content for the respective proctor, otherwise it will be wetted (or dried) and reworked as necessary. Backfill with too much moisture that, upon a visual inspection, shows pumping will be rejected and require drying and reworking. All tests must be done in the presence and under the direction of a city inspector.

Copies of all tests must be forwarded to the City Engineer or his designated representative within two weeks of the test date. The City Engineer or a city inspector may require testing at intervals greater than described if needed.

840.02 Storm Drainage Pipe Television Inspection: Storm drain pipe shall be inspected by television in the same manner as a wastewater main per specification item 833.

### **850 Pavement Testing**

850.01 Laboratory Testing of Embankment and Subgrade: Embankment and subgrade will be tested for density and moisture content at the rates specified in Section 200, Street Specifications.

850.02 Laboratory Testing of Asphalt Base and Surface: Asphalt base and surfaces courses must meet the requirements as set forth in Section 200, Street Specifications.

850.03 Laboratory Testing of Flexible Base for Concrete: Flexible base for Portland cement concrete will be tested and must meet the requirements as set forth in Section 200, Street Specifications.

850.04 Laboratory Testing of Concrete Pavement: Portland cement concrete pavement will be tested and must meet the requirements as set forth in Section 200, Street Specifications.