Section 13

Testing and Inspection of Water Mains, Reclaimed Mains, Wastewater Force Mains, and Gravity Sewer Lines

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13.01 Pressure and Leakage Tests of Underground Pressure Piping

A. No testing will be permitted until record drawings have been submitted and approved by IRCDUS.

B. Prior to conducting pressure and leakage tests, all new water and reclaimed water pipelines shall be full bore flushed (see Drawing W-9) and all pipelines including wastewater force mains shall be thoroughly cleaned to remove all dirt, stones, pieces of wood, and any other materials that may have entered the pipeline during construction, and all dirty water and/or discolored water from the pipelines. After this cleaning, if any obstructions remain, they shall be removed. All debris cleaned from the pipelines shall be removed from the job site. Hydrostatic pressure and leakage tests shall conform to AWWA Standard Specifications C-605-94, or latest edition, for PVC pipe. Hydrostatic pressure and leakage tests shall conform to AWWA Standard Specifications C-600-99, or latest revision, for DIP. The Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line. IRCDUS shall be present during all testing, televising, and final inspections.

The pressure required for the field hydrostatic pressure test shall be not less than 150 psi for water mains, reclaimed water mains and for sewer force mains. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks at least 1 inch in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least 2 hours.

Allowable amount of makeup water for expansion during the pressure test of the pipe shall conform to Plastic Pipe Institute (PPI) Handbook of Polyethylene Pipe; Inspection, Tests, and Safety Considerations, unless otherwise approved by IRCDUS. The Operating Safety Considerations, Post Installation, Hydrostatic Testing, Monitored Make-up Water Test, Table III, is on Pages 24 and 25 of the Handbook.

C. The leakage test may be conducted concurrently with the hydrostatic pressure test and shall be of not less than 2 hours duration. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines that fail to meet tests shall be repaired and re-tested as necessary until satisfactory test requirements are complied. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipelines shall be tested in such sections as may be directed by IRCDUS by shutting valves or installing temporary plugs as required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the

Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage. Testing shall be in accordance with the applicable provisions as set forth in Section 13 of AWWA Standard Specification C-600-99, or latest revision. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{ND \times (P)^{1/2}}{7400}$$

L = allowable leakage in gallons per hour

N = number of joints in the section tested

D = nominal diameter of the pipe in inches

P = average test pressure maintained during the leakage test in pounds per square inch gauge

D. The Contractor shall remove and adequately dispose of all blocking material and equipment after completion and acceptance of the field hydrostatic test, unless otherwise directed by IRCDUS. The Contractor shall repair any damage to the pipe coating. Lines shall be totally free and clean prior to final acceptance.

E. IRCDUS must be present during testing.

F. If thrust blocks have been approved for use, thrust blocks shall not be backfilled until inspected by IRCDUS.

G. At the beginning of the testing period, thoroughly clean all new pipelines by whatever means necessary, including flushing, to remove all dirt, stones, pieces of wood, other material that may have entered during the construction period, and any dirty or discolored water from the lines. If, after this cleaning, any obstructions remain, they shall be removed. All debris cleaned from the lines shall be removed from the job site.

H. All PE water mains and service lines shall be field-tested. The Contractor shall supply all labor, equipment, material, gauges, pumps, meters and incidentals required for testing. The Contractor shall pressure test each water main upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.

I. All water mains shall be tested to a minimum of 150 psi. The test pressure shall be measured on site in the presence of IRCDUS personnel during the test period.

J. Testing shall be conducted after backfilling has been completed and before placement of permanent surface.

K. Allowable amount of makeup water for expansion during the pressure test of the pipe shall conform to Plastic Pipe Institute (PPI) Handbook of Polyethylene Pipe; Inspection, Tests, and Safety Considerations, unless otherwise approved by IRCDUS. The Operating Safety Considerations, Post Installation, Hydrostatic Testing, Monitored Make-up Water Test, Table III, is on Pages 24 and 25 of the Handbook.

L. In any test of pipe laid, disclosed leakage or significant pressure drop greater than that allowed, the Contractor shall, at its own expense, locate and repair the cause of leakage and retest the line. The amount of leakage that may be permitted shall be in accordance with AWWA Standard Specifications.

M. All visible leaks are to be repaired regardless of the amount of leakage.

13.02 Disinfecting Potable Water Lines

A. Before being placed in service, all potable water pipelines shall be disinfected in accordance with AWWA Standard Specifications C-651-99, or latest revision. The location of the chlorination and sampling points will be as shown on the drawings. The Contractor shall uncover and backfill taps for chlorination and sampling, as required.

B. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages in accordance with Table 10-1 through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solutions shall remain in the pipeline for no less than 24 hours.

C. The use of chlorine tablets is strictly prohibited.

D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. The Contractor's lab shall then make bacteriological sampling and analysis of the replacement water in full accordance with AWWA Standard Specifications C-651, or latest revision. The Contractor will be required to re-chlorinate, if necessary. The line shall not be placed in service until all the requirements of the Florida Department of Environmental Protection are met and a letter of clearance issued with a copy provided to IRCDUS.

E. Special disinfecting procedures shall be used in connections to existing mains where the method outlined above is not practical.

F. The Contractor shall make all arrangements necessary with an independent commercial laboratory approved by the National Environmental Laboratory Accreditation Program (NELAP) for the collection and examination of samples of water from disinfected water mains. Note: The Contractor may not collect his own samples. These samples shall be examined for compliance with the Florida Department of Environmental Protection's requirements. Sampling shall be made daily

and continuously until two successive examinations are found satisfactory. Should one examination be found unsatisfactory, the line shall be flushed and disinfected again. Certified copies of all laboratory analyses shall be provided to the IRCDUS. The cost of all sampling, flushing and disinfecting shall be included in the contract price. IRCDUS shall operate all valves and be present to determine and control the volume of water used for flushing.

Table 10-1

Chlorine Required to Produce a 25 mg/l Concentration in 100 feet of Pipe

Pipe Diameter (inches)	100% Chlorine (pounds)	1% Chlorine Solution (gallons)
4	0.013	0.16
6	0.030	0.36
8	0.054	0.65
10	0.085	1.02
12	0.120	1.44
16	0.217	2.60
Greater than 16	See AWWA Standards Specifications C-651-99	

13.04 Testing of Gravity Sewer Lines

A. No testing will be permitted until record drawings have been submitted and approved by IRCDUS.

B. Leakage test by exfiltration and infiltration, as described below, shall be made on all pipes.

C. Exfiltration tests shall be made on all pipes after backfilling. All sewers shall be tested such that water is filled to the rim of the lowest manhole being tested within each section being tested, as directed by the IRCDUS. Mechanical plugs shall be used on the gravity sewer system in such a manner that the air can be released from the sewer while it is being filled with water. The test shall be continued for one hour and provisions shall be made for measuring the amount of water required to maintain the water at a constant level during this period. If test results are unsatisfactory, IRCDUS may direct that additional test be made on any section or the entire pipe.

D. If any joint shows an appreciable amount of leakage, the jointing material shall be removed and joint remade. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant level in the sewer for one hour does not exceed 100 gallons per inch of diameter per day per mile of sewer and if all the leakage is not

confined to a few joints, the workmanship shall be considered satisfactory. If the amount of leakage indicates defective joints or broken pipes, the Contractor shall correct them.

E. Pipe shall be tested for infiltration after the backfill has been placed. Infiltration tests shall be made under the supervision IRCDUS. The length of line to be tested shall be as directed by IRCDUS. The allowable infiltration shall be 100 gallons per inch of diameter per day per mile of sewer.

F. Rate of infiltration shall be determined by means of V-notch weirs, pipe spigot or by plugs in the end of the pipe, to be provided and installed by the Contractor in an approved manner and at such times and locations as may be directed by IRCDUS.

G. In an inspection of the completed sewer or any part thereof shows any manholes, pipes or joints that allow the infiltration of water in a noticeable stream or jet, the defective work or material shall be replaced or repaired, as directed by IRCDUS.

H. Leakage between two adjacent manholes may be double the amount above stated, provided the average leakage for a total length of any size does not exceed the amount first stated and provided there are not gushing or spurting leaks.

I. All water used in testing and flushing shall be furnished at the Contractor's expense. The minimum amount of water to be used is two times the volume of the pipe.

J. The Contractor may use an air test in lieu of the exfiltration test as described above. If he elects to do this, he shall submit his proposed method to the IRCDUS for approval.

K. If the results of the air test are unsatisfactory, as determined by IRCDUS, the Contractor shall be required to perform the exfiltration test as outlined above.

L. At the conclusion of the work, the Contractor shall thoroughly clean the entire inside of the pipe by flushing with water or other means to remove all dirt, stones, and pieces of wood or other material that may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. If, after this outlet cleaning, obstructions remain, they shall be removed. After the pipe is cleaned and if the groundwater level is above the pipe, or following a heavy rain, the IRCDUS will examine the pipe for leaks. If defective pipes or joints are discovered at this time, the Contractor shall repair them at no expense to IRCDUS.

M. Upon completion of the work, the sewer system or selected sections therein shall be subjected to a final test and inspection. All work in the system or sections therein being tested shall be complete, cleaned and

ready for use. Tests shall be as specified herein and shall meet all requirements as to line, grade, clean lines, infiltration, exfiltration and workmanship.

N. Inspection of mains shall be by use of a self-contained television system and lamping upon satisfactory completion and acceptance of final road base material. The facilities shall be provided and operated by the Contractor as specified below:

The Contractor shall provide IRCDUS with a video record, on CD format, of the interior of all main line gravity sewers and the interior of all sewer laterals. The CD shall be contained in a proper container to prevent damage to the CD. The video shall be obtained by pulling a television camera through the line along the axis of the pipe. The television equipment shall consist of a self-contained camera and a monitoring unit connected by a coaxial cable. These videos shall be done during the inspection of the mains. Monitors shall be available to IRCDUS during these inspections. Monitors shall also be provided with a stop action camera, so that as may be requested by IRCDUS. Photographs shall be made of a particular portion of the main being viewed. The video shall be properly exposed and the camera shall be in proper focus so that good, clear recordings showing detail are produced. The visual recordings shall be identified by audio recordings noting the manhole numbers, distances to service lateral connections, direction of lateral connection and any leaks, cracks or pipe defects. Each CD shall be clearly marked as to the contents and number, with an index of all CD's. The CD's of the completed mains shall be delivered to IRCDUS. The Contractor shall provide any assistance required by the IRCDUS.

O. A maximum tolerance of ½" dip will be accepted in gravity sewer construction.

END OF SECTION