

DIVISION 33 – UTILITIES
SECTION 33 08 10 – TESTING OF RECLAIMED WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Provisions testing of reclaimed waterlines.

- B. Related Work:
 - 1. Section 33 11 00 – Reclaimed Water Utility Distribution Piping
 - 2. Section 33 13 00 – Disinfection of Reclaimed Water Utility Distribution

1.02 REFERENCES

- A. American Water Works Association
 - 1. AWWA C900, PVC Pipe and Fabricated Fittings, 4 inch through 12 inch, for Water Transmission and Distribution.
 - 2. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch for Water Distribution and Transmission
 - 3. AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3 in., Through 48 in., for Water and Other Liquids AWWA.

- B. Plastic Piping Institute:
 - 1. PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings.

1.03 SUBMITTALS

- A. Submit in accordance with requirements of Section 01 33 00.

- B. Product Data: Prepare and submit schedules and procedures to the Authority for testing reclaimed water piping. Submit schedule and procedure a minimum of forty-eight (48) hours prior to each test.

- C. Quality Assurance/Control Submittals
 - 1. Test Reports: Submit test reports documenting test conditions and results. Certify all test reports with a signature and obtain a signature of the Authority's test witness.

1.04 QUALITY ASSURANCE

- A. Design Criteria for Testing Water Mains:
 - 1. Required Test Pressures: The reclaimed water mains shall be tested as specified.
 - 2. Pressure shall not vary more than +/- 5 psi from the required test procedures.
 - 3. Required test pressures shall be provided by the Authority during preparation of testing schedules.

PART 2 – PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Conduct tests specified so that each pipe line installed in the project is tested to the Engineer's satisfaction. All piping shall be properly flushed and tested unless otherwise approved by the Authority.
- B. The Contractor shall furnish and install all means and apparatus necessary for getting the air or water into the pipeline for flushing and testing including pumps, pipe connection to main, compressors, gauges, and meters, any necessary plugs and caps, and any required blow-off piping and fittings, etc., complete with any necessary reaction blocking to prevent pipe movement during the flushing and testing. The Contractor shall provide water for all flushing and testing of pipelines. Reclaimed water may be used for flushing and testing pipelines not connected to the potable water system.
- C. Contractor shall thoroughly clean all new pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, etc., which may have entered the pipe during the construction period. Obstructions remaining after flushing shall be corrected by the Contractor, at his own expense, to the satisfaction of the Authority. Pipelines shall be flushed at the rate of at least 3.0 feet per second for a duration suitable to the Authority or shall be flushed by other approved methods.

3.02 INSPECTION

- A. Inspect each section of pipe, joint alignment, and each pipe fitting prior to backfilling to assure the maximum deflection present in each joint does not exceed the manufacturer's recommendations.
- B. Any and all defects shall be corrected by the Contractor at no cost to the Authority and to the satisfaction of the Authority prior to backfilling. Remove rejected pipe and/or fittings from project.
- C. Pipelines shall be inspected to assure the lines are installed at a constant or increasing grade to eliminate the possibility for air accumulation at an intermediate high point.

- D. The Authority reserves the right to control and inspect the pipe system testing procedure and to determine the acceptability of tests.
1. Conduct pressure and leakage tests specified so that each water main installed in the Project is tested to the Authority's satisfaction.
 2. The hydrostatic test shall be in accordance with the requirements of AWWA C600 for ductile iron pipe and AWWA C605 for plastic pipe. The hydrostatic test shall be in accordance with the requirement of ASTM F 2164 for PE pressure piping.
 3. The hydrostatic testing equipment and installation shall be satisfactory to the Authority prior to testing.
 4. Conduct the hydrostatic pressure and leakage tests in the presence of and to the satisfaction of the Authority.
 5. When the length of a reclaimed water main exceeds 1,200 feet, the Authority reserves the right to require that the water main be tested in sections, the length of each section to be determined by the Authority.
 6. Water for testing shall be furnished by the Contractor. The Contractor may utilize the existing reclaimed water system for the quantities required; however, the Contractor must coordinate all arrangements and conform to the reclaimed water utility's standards for use and connection.
 7. The Contractor will be required to perform hydrostatic pressure testing concurrent with installation of the pipe system.
 8. No testing will be authorized unless ambient air temperature is 35° or higher.
 9. Any leaks or defective pipe discovered by the hydrostatic test shall be repaired or replaced by the Contractor, at his own expense, and the test repeated until all piping passes the specified test.
- B. Preparation:
1. The Contractor may, at his option, completely backfill the trench or partially backfill the trench over the center section of each pipe length prior to carrying out the pressure test. The Authority reserves the right, however, to direct that the entire trench be backfilled, if traffic or other local conditions require such action.
 2. The section of water main being tested must be filled with water a minimum of 24 hours before the main is tested.
 3. The test shall be made by closing valves, when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Care shall be taken to see that all air vents are open during filling.
 4. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is

used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

5. The pipelines shall be filled at a rate that will not cause any surges or exceed the rate at which the air can be released through the air valves or temporary vents at a reasonable velocity; all the air within the pipelines shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for a sufficient length of time to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the Authority shall be taken.

C. Pressure Test:

1. After the pipeline has been filled with water for 24 hours, conduct a pressure test, for a duration of at least two (2) hours. Test pressures for each section of water main to be tested shall equal 150% of working pressure, but not less than 125% of normal working pressure at highest elevation. The Authority shall supply the average working pressure at each area of work.
2. Apply the specified test pressure by means of a pump connected to the pipe in a manner satisfactory to the Authority. Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants or blow offs are not available at high places, Contractor shall make the necessary taps at points of highest elevation before the test is made and insert the plugs after the test has been completed, at no cost to the Authority. Extreme care must be exercised to insure that all air is expelled from the pipeline during the filling.
3. Carefully examine all exposed pipes, joints, fittings, and valves during the test, and tighten all joints showing visible leakage. Remove all defective pipe, fittings, and valves from the line and replace.
4. The section under test shall be brought back to test pressure at one-half hour intervals during the testing should re-pressurization be needed. Record both the makeup water amount and pressure at each one-half hour re-pressurization.

D. Leakage Test:

1. Conduct concurrently with the pressure test.
2. Provide suitable means to measure the leakage during the pressure test, and a record of water added to the pipeline shall be kept for a period of at least two (2) hours.
3. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valve section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe filled with water.
4. All piping inside chambers, valve pits, etc. shall show no leakage.
5. **Ductile Iron Pipe:** Leakage in Ductile Iron pipelines shall be acceptable when it is less than the amount calculated by the following formula:

$$L = S * D * P^{1/2}$$

148,000

- L = Allowable Leakage (gph)
- S = Length of Pipeline Tested (ft)
- D = Nominal Diameter of Pipe (in)
- P = Average test pressure during test period (psig)

Allowable Leakage (GPH) per 1,000 feet of Ductile Iron Pipe is defined by the following table:

Avg. Test Pressure (psi)	4" Nom. Pipe Diameter	6" Nom. Pipe Diameter	8" Nom. Pipe Diameter	10" Nom. Pipe Diameter	12" Nom. Pipe Diameter
300	0.47	0.70	0.94	1.17	1.40
275	0.45	0.67	0.90	1.12	1.34
250	0.43	0.64	0.85	1.07	1.28
225	0.41	0.61	0.81	1.01	1.22
200	0.38	0.57	0.76	0.96	1.15
175	0.36	0.54	0.72	0.89	1.07
150	0.33	0.50	0.66	0.83	0.99
125	0.30	0.45	0.60	0.76	0.91

6. **High Density Polyethylene (HDPE) Pipe:** Leakage in HDPE pipelines shall be acceptable when it is less than the amount described below. During the initial expansion phase of the test the length of pipe being tested is pressurized to 10 psi higher than required target pressure (target pressure + 10psi) for duration of 4 hours, For the test phase of the test reduce the pressure to the target pressure. If after one hour the pressure is within 5% of the target pressure then the test pipe is determined to have no leakage.
7. **Polyvinyl Chloride (PVC) Pipe:** Leakage in PVC pipelines shall be acceptable when it is less than the amount calculated by the following formula:

$$Q = \frac{L * D * P^{1/2}}{148,000}$$

- Q = Allowable Leakage (gph)
- L = Length of Pipeline Tested (ft)
- D = Nominal Diameter of Pipe (in)
- P = Average test pressure during test period (psig)

Allowable Leakage (GPH) per 1,000 feet of PVC Pipe is defined by the following table:

Avg. Test Pressure (psi)	4" Nom. Pipe Diameter	6" Nom. Pipe Diameter	8" Nom. Pipe Diameter	10" Nom. Pipe Diameter	12" Nom. Pipe Diameter
300	0.47	0.70	0.94	1.17	1.40
275	0.45	0.67	0.90	1.12	1.34

250	0.43	0.64	0.85	1.07	1.28
225	0.41	0.61	0.81	1.01	1.22
200	0.38	0.57	0.76	0.96	1.15
175	0.36	0.54	0.72	0.89	1.07
150	0.33	0.50	0.66	0.83	0.99
125	0.30	0.45	0.60	0.76	0.91
100	0.27	0.41	0.54	0.68	0.81
75	0.23	0.35	0.47	0.59	0.70

3.04 ACCEPTANCE

- A. Acceptance: Observation of successful testing of piping by the Authority does not constitute acceptance of the system or any portion thereof. Only upon final inspection by the Authority and upon written acceptance will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period will commence. If, during the final inspection, any irregularities are observed, the condition must be corrected at no cost to the A Authority.