SECTION 15044
PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This section specifies the leakage and pressure testing of piping.

B. Testing Records:

1. Provide record of each piping installation during the testing. These records shall include:

   a. Date of test.

   b. Identification of pipeline tested or re-tested.

   c. Identification of pipeline material.

   d. Identification of pipe section tested.

   e. Test pressure

   f. Remarks: Leaks identified (type and location), types of repairs, or corrections made.

   g. Certification by Contractor that the leakage rate measured conformed to the Specifications.

   h. Signature of Project Manager witnessing pipe test.

2. Submit five (5) copies of the test records to the Owner/Engineer upon completion of the testing.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Testing fluid shall be water, unless specified otherwise.

B. All testing shall be performed in accordance with applicable AWWA Standards (C-600) latest edition.

2.02 MATERIALS AND EQUIPMENT

A. Provide pressure gauges, pipes, pipe fittings, bulkheads, hydraulic force pumps, meters and graduated containers to perform the hydrostatic testing.

B. Pressure gauges used shall have been calibrated just prior to their use.
PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. Pipes shall be in place and anchored before commencing pressure testing.

B. Conduct hydrostatic tests on exposed and above ground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves and meters.

C. Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris.

D. Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, plugs, special flanges, or blind flanges. After the new line has been successfully tested, and all other tests/certifications/releases have been obtained, remove caps or flanges and connect to the existing piping.

3.02 HYDROSTATIC TESTS (DUCTILE IRON AND PVC PIPE)

A. General

Hydrostatic tests shall consist of a pressure test and a leakage test. Hydrostatic tests shall be conducted on all newly installed pressure pipes, joints, valves and all service lines from tapped connection of main to the curb stops. AIR TESTING of pressure pipes WILL NOT BE PERMITTED under any circumstance. Tests may be made on sections not exceeding 2,000 feet, or as field conditions dictate. Length of the pipe to be tested shall be acceptable to The City of Palm Coast. Contractor shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required.

The Contractor may conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for his informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified. Where any section of pipe is provided with concrete thrust blocking or encasement, pressure test will not be made until at least seven days have elapsed after the thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be reduced to 3 days if The City of Palm Coast concurs that the concrete has cured and reached adequate strength. When testing mortar-lined or PCCP pipe, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

B. Testing Criteria

All pipe sections to be pressure tested, including water mains, reuse mains and force mains, shall be subjected to a hydrostatic pressure of 150 psi. The duration of each pressure test shall be for a period of 2 hours. If during the test, the integrity of the tested line is in question, The City of Palm Coast may require a 6-hour pressure test. The basic provisions of AWWA C-600 and C-605/M23 shall be applicable.

C. Procedure for Pressure Test
Each section of pipe to be tested, as determined by The City of Palm Coast, shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings, valves, or hydrants are discovered in consequence of this pressure test, all such items shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of AWWA C600 and C605/M23, where applicable, shall apply.

D. Procedure for Leakage Test

After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Applicable provisions of AWWA C600 and C605/M23 shall apply.

Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

\[ L = \frac{SD(P)^{\frac{1}{2}}}{133,200} \]

- \( L \) = 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 leakage test in pounds per inch gauge.

Leakage is defined as the quantity of water to be supplied in the newly installed pipe or any valved section under test, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe installed disclose leakage greater than that allowed, Contractor shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

3.03 HYDROSTATIC TESTS (HDPE PIPE)

A. GENERAL

Contractor shall test pipelines installed under this Contract in accordance with these specifications prior to acceptance of the pipeline by The City of Palm Coast. All field tests shall be made in the presence of The City of Palm Coast. Except as otherwise directed, all pipelines shall be tested. All piping to operate under liquid pressure shall be tested in sections of approved length. The pressure testing of an HDPE line section shall be tested separately from the PVC and DIP line sections. Where impractical, the HDPE test section shall include only a minimum amount of PVC and ductile iron pipe within the test section. If at all possible, the PVC and DIP test sections shall be left exposed during the pressure test for visual leakage observation. For these tests, the Contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment, and all labor required. If the Contractor chooses to pressure test against an existing City of Palm Coast water main / valve, the new water main must be disinfected prior to connection to the City of Palm Coast line. The City of Palm Coast will not be responsible for failure of the pressure test due to the existing valve leaking. The City of Palm Coast may elect to furnish suitable pressure gauges for these tests. If not, the Contractor will furnish suitable pressure gauges, calibrated by an approved testing laboratory, which increments no greater than 2 psi.
Gauges used shall be of such size that pressures tested will not register less than 10 percent or more than 90 percent of the gauge capacity. All valved sections shall be hydrostatic tested to insure sealing (leak allowance) of all line valves.

Unless it has already been done, the section to pipe to be tested shall be filled with potable water and air shall be expelled from the pipe. If blow-offs or other outlets are not available at high points for releasing air, the Contractor shall provide 1-inch [minimum taps and blow-off valves (at the 12:00 position)], as necessary. The cost of constructing blow-off valves and plugging them, after a successful pressure test, shall be included in the unit price bid amount for the HDPE pipe.

B. TESTING CRITERIA

Hydrostatic testing shall consist of a 150 psig test pressure, based on the elevation of the highest point of the line or section under test. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to The City of Palm Coast. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor and shall be subject to the approval of The City of Palm Coast.

Maximum duration for pressure test, including initial and final phase of the test, shall not exceed eight (8) hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section, and then allow it to “relax” for at least eight (8) hours before bringing the test section up to test pressure again.

C. PROCEDURE FOR PRESSURE TEST

Initial Phase of Pressure Testing: First, all air must be removed from the test section. The pressure test shall be completed after the line is backfilled. If possible, all flanged or mechanical joint valves and fittings shall be left exposed for visual leak inspection. If possible all PVC and DIP test sections shall be left exposed for visual leak inspection. Initially, the pressure within the test section shall be raised to approximately 160 psi and then allowed to be idle (no additional make-up water / pressure to be injected), for approximately 3 hours. During this 3-hour period, the test section shall be allowed to stabilize and come to an equilibrium stage. No additional make-up water / pressure shall be applied to the test section during this 3-hour stabilization period unless the line pressure drops below 140 psi. In this case, make-up water / pressure shall only be applied to the test section to maintain a minimum of 140 psi (during the 3-hour stabilization period).

Final Phase of Pressure Testing: The final phase of the pressure test shall involve applying make-up water / pressure to achieve an “Initial test pressure” of 150 psi (minimum) / 155 psi (maximum). The test section is then allowed to be idle (no make-up water / pressure is added) for a period of 2 hours. After this 2-hour period, make-up water / pressure is applied and measured to re-establish the “initial test pressure.” The quantity of water utilized to re-pump the line shall be measured and compared to the allowable quantities as determined by the table shown on the following page. If the actual make-up water quantity is equal to or less than the allowable amount, the pressure test passes. If the actual make-up water quantities are greater than the allowable amount, the pressure test fails.
TABLE 1: ALLOWABLE MAKE-UP AMOUNT

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inches)</th>
<th>Make-up Water Allowance (U.S. Gallons /100 ft. of Pipe)</th>
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<tbody>
<tr>
<td></td>
<td>2-Hour Test</td>
</tr>
<tr>
<td>6</td>
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<td>8</td>
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<tr>
<td>54</td>
<td>15.70</td>
</tr>
</tbody>
</table>

In the event a section fails to pass the tests, the Contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section), and replace the defective pipe, valve, fitting or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested as necessary until test requirements are complied with. All testing shall be performed at the Contractor’s expense.

3.04 TESTS FOR NON-PRESSURE PIPING

A. GENERAL

Testing of non-pressure gravity flow pipe shall be accomplished by infiltration or exfiltration testing. Non-pressure piping which has a crown elevation below the groundwater table shall be tested by measuring the infiltration. Non-pressure piping which has a crown elevation above the groundwater table shall be tested by measuring the exfiltration.

B. INFILTRATION TESTING
The Contractor shall identify and prepare each section of piping to be tested. The designated piping shall be monitored for a minimum period of four (4) hours. Any accumulated liquid shall be measured; the line shall not be accepted until this measured quantity is less than 25 gallons per inch of diameter of pipe per mile of pipe per 24 hours. All buried leaks shall be located and repaired immediately and retested. All visible leaks must be repaired regardless of the measured leakage.

C. EXFILTRATION TESTING

The Contractor shall close all openings in the section of pipe to be tested. The hydrostatic water level of the pipe system shall be raised to a height equal to the maximum design submergence, but in no case less than 3 feet above the highest point in the line. The closed system shall be maintained for a minimum duration of 4 hours. Any loss of volume shall be noted. The line will not be accepted until this measured quantity is less than 25 gallons per inch of diameter of pipe per mile of pipe per 24 hours. All buried leaks shall be located and repaired as soon as possible. All visible leaks must be repaired regardless of the measured leakage.

D. LOW PRESSURE TESTING

If impractical to conduct the infiltration or exfiltration tests as specified, the line can be pressurized for low pressure air testing. The air test shall be made by attaching an air compressor or testing apparatus to a suitable opening. After closing all other inlets and outlets to the system, force air into the system until there is a uniform gauge pressure of 5 psi. This pressure shall be held constant without introduction of additional air for a period of at least 30 minutes.

E. MANHOLE TESTING

The allowable limits of infiltration or exfiltration of manholes shall not exceed a rate of 0.165 gallons per manhole per hour.

F. RE-TESTING

Should any test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water and all other items required to conduct the required testing and shall perform the necessary system repairs required to comply with the specified test.

END OF SECTION