

SECTION 221101 – LEAK TEST PLUMBING PIPING SYSTEMS

Latest Update 06-07-2021 See Underlined Text for Edits.

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all “Underlines”.)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 22.

1.2 SUMMARY

- A. This Section includes leak testing of the following systems: <Delete piping systems not applicable to the project, or add piping systems not listed that are applicable to the project.>
 - 1. Sanitary waste and vent piping.
 - 2. Storm water piping.
 - 3. Domestic water system.
 - 4. Laboratory water system.
 - 5. RO/DI piping.
 - 6. Compressed air piping.
 - 7. Vacuum piping.
 - 8. Laboratory natural gas piping.
 - 9. Laboratory specialty gas piping (Bottled gases)
 - 10. Pumped Sanitary and Storm Water (same as hydronic piping)

1.3 SUBMITTALS

- A. General: Submit completed certified test reports in “pdf” format for each item in this Section according to the conditions of the contract and Division 01 Specification Sections.

1.4 QUALITY ASSURANCE

- A. Testing shall be performed by the installer of system being tested in presence of the UMB Representative.

1.5 WARRANTY/GUARANTEE

- A. See Division 22, Specification Section “Basic Mechanical Requirements – Plumbing” for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 PIPE SYSTEM LEAK TEST APPARATUS

- A. The contractor conducting the test shall arrange for and provide all temporary services, all test apparatus, all gages, hoses and qualified personnel necessary to conduct the required testing. All leak tests shall be witnessed by UMB's Representative. UMB requires a minimum of seven (7) business days' notice for all leak test. Prior to scheduling the test with the University the contractor shall pretest the system or segment to ensure all joints, connections etc. are leak free.
- B. Test apparatus shall include a pump of appropriate size and pressure for all pressurized systems and an oil free air compressor or gaseous nitrogen to pressurize all gaseous piping systems to the required test pressures. Gauges used for testing shall be as follows:
 - 1. Gauges shall be four (4) inch diameter dial type gauges.
 - 2. Tests requiring a pressure of 10 pounds per square inch (psi) or less shall utilize a testing gauge having increments of 0.10 psi or less.
 - 3. Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
 - 4. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.
- C. Pressure gauges used for the test shall be in the required range and increment for the appropriate test.
- D. All gauges must be set at zero (0) before pressure is applied to the test segment.
- E. The contractor conducting the test shall utilize the "UMB Standard Pipe System Leak Test Summary Form" for each pipe test to record the test results. Where multiple tests are conducted on the same pipe section a summary report of each test (pass and failed test) shall be prepared. Each summary report shall be signed by each of the parties witnessing the test. The completed reports shall be forwarded to the Construction Manager (CM) or the General Contractor (GC). The CM or GC shall provide a copy of the reports to UMB Project Manager.

PART 3 - EXECUTION

3.1 BUILDING DRAINAGE PIPING SYSTEMS

- A. The Contractor conducting the test shall provide the necessary test plugs appropriately sized for the piping to be tested, air compressor, the temporary ten (10) foot vertical pipe and shall use the specified Test Procedure for the Building Drainage Piping Systems. The Building Drainage Piping Systems include all: Storm Water, Sanitary Waste, Acid Waste, Sanitary Vent and Acid Vent Piping Systems both in the building below floor slabs, above floor slabs concealed and exposed and below grade to a point five (5) feet beyond the exterior foundation walls.
- B. Except for outside leaders and perforated or open-jointed drain tile, test all piping as a whole or in sections as required by progress of work in the plumbing drainage and venting

systems below grade and floor slabs and above floor slabs on completion of roughing-in piping installation

1. Where the Building Drainage Piping Systems and/or segments or installed below floor slabs or below grade that portion of the system must be tested and proven leak free before the excavation is back filled and/or floor slabs are poured. The circumference of all pipe joints must be exposed for the test period.
 2. Where the Building Drainage Piping Systems and/or segments or installed above floor slabs in walls, partitions, shafts or above ceilings that portion of the system must be tested and proven leak free before the walls, partitions, shafts and/or ceilings are closed in.
- C. For Building Piping Drainage Systems above floor slabs inside the building provide a ten (10) foot section of vertical pipe that is connected to the pipe system or segment that is to be tested. Tightly close all openings in piping system and fill the piping slowly with water to the point of overflow at the top of the vertical pipe. The water level shall not drop during the one (1) hour test period. During the test period inspect the joints for leaks. If no leaks are detected and the water level has not dropped then the tested pipe system or segment has passed the test. Remove the test plugs, drain the piping and remove the ten (10) foot vertical pipe used for the test unless that pipe section can be used for the next installed segment of piping.
- D. For Building Piping Drainage Systems below grade within five (5) feet of the building, below the floor slabs inside the building provide a ten (10) foot section of vertical pipe that is connected to the pipe system or segment that is to be tested. Tightly close all openings in piping system and fill the piping slowly with water to the point of overflow at the top of the vertical pipe. The water level shall not drop during the one (1) hour test period. During the test period inspect the joints for leaks. If no leaks are detected and the pressure has not dropped then the tested pipe system or segment has passed the test. Remove the test plugs and evacuate the compressed air in the piping.
- E. If leaks are detected and/or the water level has dropped then the tested pipe system or segment the test has failed. After the leaks have been corrected by tightening, repairing or replacing components as appropriate the appropriate test shall be rescheduled with the University. The test procedure shall be repeated as specified above until there are no leaks and there is no allowable drop in the water level or pressure.
- 3.2 DOMESTIC WATER, LABORATORY WATER, AND REVERSE OSMOSIS/DE-IONIZED WATER (RO/DI) PIPING SYSTEMS
- A. The contractor conducting the test shall use this Test Procedure for Domestic Water and RO/DI Piping Systems. Test each pipe system as a whole or in segments as required by progress of the work. Perform tests prior to installation of piping insulation.

- B. All Piping Systems include piping exposed and concealed above grade within the building, piping below floor slabs within the building, piping below grade five (5) feet beyond the exterior foundation wall, and / or piping above the building roof elevation and are defined as follows:
1. Domestic Water Piping Systems include all Cold Water, Hot Water, Hot Water Recirculating Piping serving non laboratory areas of the building and/or the project area.
 2. Laboratory Water Piping Systems include all Cold Water, Hot Water, Hot Water Recirculating Piping and RO/DI Piping serving laboratory areas of the building and/or the project area.
- C. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
- D. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of the liquid.
- E. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
- F. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than one and one half (1-1/2) times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90% of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code For Pressure Piping, Building Services Piping.
- G. After the hydrostatic test pressure has been applied for one (1) hour and with no allowable drop in pressure, the tested system or segment has passed the leak test. If after the one (1) hour test period there is a loss in pressure below the initial test pressure, the test has failed and the contractor shall examine piping, joints, and connections for leakage. After all leaks have been corrected by tightening, repairing, and/or replacing components as appropriate, the hydrostatic test shall be rescheduled with the University. The test procedure shall be repeated as specified above until there are no leaks and there is no loss in pressure.
- H. Systems using Pro-Press piping connectors shall perform a pre-test at 30 psi for 10 minutes. After the hydrostatic test pressure has been applied for ten (10) minutes and with no allowable drop in pressure, the tested system or segment has passed the Pro-Press leak pre-test. If after the ten (10) minute test period there is a loss in pressure below the initial test pressure, the test has failed and the contractor shall examine piping, joints, and connections for leakage. After all leaks have been corrected by tightening, repairing, and/or replacing components as appropriate, the hydrostatic test shall be rescheduled with the University.

The test procedure shall be repeated as specified above until there are no leaks and there is no loss in pressure.

- I. Where backflow preventers are installed in piping systems scheduled for testing isolate the backflow preventer from the piping to be tested.

3.3 NATURAL GAS PIPING SYSTEM

- B. The contractor conducting the test shall use this Test Procedure for Natural Gas Piping Systems. Test each pipe system as a whole or in segments as required by progress of the work. Cap and fill each system, with oil-free, dry air or dry nitrogen, to pressure of one and one half (1-1/2) times the system operating pressure, but not less than fifty (50) psig. Isolate the test source and let stand for four (4) hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for one (1) hour with no allowable drop in pressure.
- C. Inspect and purge natural gas systems in accordance with NFPA 54, and local utility requirements.
- D. After erection of the tubing, but before installation of outlet valves, the line shall be blown clear by means of dry nitrogen.
- E. After installation of outlet valves, each section shall be subject to a test pressure of at least one and one half (1-1/2) time the maximum working pressure, but not less than fifty (50) pounds per square inch by means of dry nitrogen. This test pressure shall be maintained until each joint has been examined for leakage by means of Oxweld No. 23 Lake Test Solution of other non-frothing solutions approved for this purpose.
- F. Where leakage or other defects are located in each system, the affected portion of the piping system shall be repaired or replaced in that section of piping. After the leaks have been corrected by tightening, repairing or replacing components as appropriate the test shall be rescheduled with the University. Retesting can occur no sooner than five (5) business days after a failed test. The test procedure shall be repeated as specified above until there are no leaks and there is no allowable drop in pressure.
- G. Before the installation of outlet valves and placing the system in service each laboratory gas piping system shall be purged with dry nitrogen.

3.4 COMPRESSED AIR, VACUUM, AND BOTTLED GAS PIPING SYSTEMS

- A. The contractor conducting the test shall use this Test Procedure for Compressed Air, Vacuum, and Bottled Gas Piping Systems. Test each pipe system as a whole or in segments as required by progress of the work. Cap and fill each system, with oil-free, dry air or dry nitrogen, to pressure of fifty (50) psig above system operating pressure, but not less than one hundred and fifty (150) psig. Isolate the test source and let stand for four (4) hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for one (1) hour with no allowable drop in pressure.

- B. After erection of the tubing, but before installation of outlet valves, the line shall be blown clear by means of dry nitrogen.
- C. After installation of outlet valves, each section shall be subject to a test pressure of at least one and one half (1-1/2) times the maximum working pressure, but not less than fifty (50) pounds per square inch by means of dry nitrogen. This test pressure shall be maintained until each joint has been examined for leakage by means of Oxweld No. 23 Lake Test Solution of other non-frothing solutions approved for this purpose.
- D. Where leakage or other defects are located in each system, the affected portion of the piping system shall be repaired or replaced in that section of piping. After the leaks have been corrected by tightening, repairing or replacing components as appropriate the test shall be rescheduled with the University. Retesting can occur no sooner than five (5) business days after a failed test. The test procedure shall be repeated as specified above until there are no leaks and there is no allowable drop in pressure.
- E. Before the installation of outlet valves and placing the system in service each laboratory gas piping system shall be purged with dry nitrogen.

3.5 COMPLETED HYDROSTATIC/LEAK TEST FORMS

- A. Upon completion of each hydrostatic/leak test, the contractor shall upload the signed leak test forms to the Project File, in ebuilder, in Folder 11.06 Test Reports.

3.6 UMB STANDARD HYDROSTATIC/LEAK TEST SUMMARY FORMS

- B. General: The contractor shall use the “UMB Standard Pipe System Hydrostatic/Leak Test Summary Form.”
 - 1. Sample Form: The following page contains a sample of the UMB Standard Pipe System Hydrostatic/Leak Test Summary Form.
 - 2. Availability: The standard test summary form is available on the UMB Web Site at <http://www.umaryland.edu/designandconstruction/>, under the “Documents” link.

UMB STANDARD PIPE SYSTEM HYDROSTATIC/LEAK TEST SUMMARY FORM

TEST DATA:

Date: _____ Project Number: _____

Location: _____

Pipe System Tested (Service): _____

Location and Description: _____

Pipe Materials: _____

Operating Pressure: _____

Specified Test Pressure: _____

Actual Test Pressure: _____

Pressure Test Type: _____

Test Start Time: _____ Recorded Test Pressure: _____

Test Completion Time: _____ Recorded Test Pressure: _____

Test Duration: _____ Pressure Drop or Rise: _____

Test Result (Pass/Fail): _____ Weather Conditions: _____

SIGNATURES:

Construction Manager: _____

Construction Manager Representative: _____

Mechanical Contractor: _____

Mechanical Contractor Forman: _____

UMB Division: _____

UMB Witness: _____

Remarks: _____

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