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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 16, 2009 | Modified ‘Related Sections’ |
| 3 | March 15, 2011 | Minor changes from Legal |
| 4 | December 2, 2014 | First draft review (AV) |
| 5 | June 8, 2015 | Second Draft for Review (AV) |
| 6 | September 16, 2015 | Updated, Finalized Specification – Reference eDOCS #5823640-v4 (AV) |
| 7 | September 10, 2018 | 3.2.3 Corrected leakage formula  1.2.1.2 Added reference (BM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

# GEneral

## Related Sections

### *[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

### *Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

### *Contractor is responsible for coordination of the Work.*

### *This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]*

### *[List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### *[List Sections specifying products installed but not supplied under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### *[List Sections specifying related requirements.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01300 – Submittals

#### Section 01351 – Health and Safety

#### Section 01810 - Equipment Testing and Facility Commissioning

## References

*[Delete .1 if Section 01060 – Regulatory Requirements is included in Contract Documents.]*

### Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

#### Chlorine Institute (2001 L Street N.W., Washington D.C. 28036): Pamphlet 6, Piping Systems for Dry Chlorine, 2013 edition.

#### ANSI/AWWA C-605-13 Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

## Submittals

### Informational Submittals, in accordance with Section 01300 - Submittals:

#### Testing Plan: Submit prior to testing and include the following information at a minimum.

##### Safety Plan, approved by Consultant.

##### Testing dates.

##### Piping systems and section(s) to be tested.

##### Test type.

##### Method of isolation.

##### Calculation of maximum allowable leakage for piping section(s) to be tested. *[Consultant to define acceptable leakage and incorporate into the specifications]*

#### Certifications of Calibration: Testing equipment.

#### Certified Test Report.

## Measurement and Payment

*[Choose one of the following payment language provisions that best suits the individual project.*

*If this Section is not specifically referenced by an item in the Bid Form, please use the following language:*

.1 The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

*OR If this Section is specifically referenced in the Bid Form, use the following language and identify the relevant item in the Bid Form:*

.1 All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

*If the work of this Section is to be measured and paid for by several different methods, please amend the standard wording given above to reflect the different methods of measurement and payment.*]

# PRODUCTS (NOT USED)

# EXECUTION

## Preparation

### Notify the Consultant in writing a minimum of [ ]Days in advance of testing. Perform testing in the presence of the Consultant.

### Pressure Piping:

#### Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.

#### Wait a minimum of [ ]Days after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, the wait may be reduced to [ ] Days.

#### Prior to testing, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.

#### [Chlorine ] [and] [Sulfur Dioxide] [Piping: Test, dry, and clean in accordance with requirements of Chlorine Institute Pamphlet 6.]

#### New Piping Connected to Existing Piping:

##### Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to the Consultant.

##### Test joints between new piping and existing piping by methods that do not place the entire existing system under test load, as approved by the [Consultant.]

#### Items that do not require testing include: [Piping between wet wells and wet well isolation valves,] [Equipment seal drains,] [tank overflows to atmospheric vented drains,] [tank atmospheric vents.] [and] [    .]

#### Test Pressure: [As indicated on the Piping Schedule,] [As specified in this Section,] [or as specified by the equipment manufacturer ]

### Test section may be filled with water and allowed to stand under low pressure prior to testing.

### Gravity Piping:

#### Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.

#### Determine groundwater level at time of testing by exploratory holes or other method acceptable to the [Consultant].

#### Pipe 1,050 mm Diameter and Larger: Joint testing device may be used to isolate and test individual joints.

## Hydrostatic Test for Pressure Piping

### Fluid: Clean water of such quality to prevent corrosion of materials in the piping system.

### Exposed Piping:

#### Perform testing on installed piping prior to application of insulation.

#### Maximum Filling Velocity: 0.076 metres per second, applied over full area of pipe.

#### Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.

#### Maintain hydrostatic test pressure continuously for a minimum of [30] [60] [ ]minutes, and for such additional time as necessary to conduct examinations for leakage.

#### Examine all joints and connections for leakage.

#### Correct all visible leakage and retest as specified herein.

#### [Leave pipe full of water after repair of leaks.] [Empty pipe of water prior to final cleaning or disinfection.]

### Buried Piping:

#### Test after backfilling has been completed.

#### Expel air from piping system during filling.

#### Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.

#### Maintain hydrostatic test pressure continuously for a minimum of [2] [     ]hours, reopening the isolation valve only as necessary to restore test pressure.

#### Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for the duration of the test.

#### Maximum Allowable Leakage:

where:

*Qm* = Allowable leakage, in litres per hour.  
L = Length of pipe section being tested, in metres.  
D = Nominal diameter of pipe, in millimetres.  
P = Average test pressure during leakage test, in kilopascals.

#### Correct leakage greater than allowable, and re-test as specified above.

## Pneumatic Test for Pressure Piping

### Do not perform on:

#### PVC or CPVC pipe;

#### Piping larger than [A: 450] [B: ] mm diameter; or

#### Buried and other non-exposed piping.

### Fluid: Oil-free, dry air.

### Procedure:

#### Apply preliminary pneumatic test pressure of 172 kPa maximum to piping system prior to final leak testing, in order to locate visible leaks. Apply soap bubble mixture to joints and connections; examine for leakage.

#### Correct visible leaks and repeat preliminary test until all visible leaks are corrected to the satisfaction of the Consultant.

#### Gradually increase pressure in the system to half of the specified test pressure. Thereafter, increase pressure in steps of approximately one-tenth of the specified test pressure until the required test pressure is reached.

#### Maintain pneumatic test pressure continuously for a minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.

#### Correct all visible leakage and retest as specified in this Section, at the Contractor’s own expense.

### Allowable Leakage: The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.

### After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to ensure that no explosive mixtures will be present in the system during the filling process.

## Hydrostatic Test for Gravity Piping

### Testing Equipment Accuracy: Plus or minus [1.9] [ ] litre water leakage under the specified conditions. *[Consultant to define the specified conditions based on expected piping performance and testing requirements. Consultant to ensure specified testing conditions are in the Contract Documents]*

### Maximum Allowable Leakage: [0.078] [ ] litre per hour per millimeter diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.

### [Gravity Sanitary and Roof Drain Piping: Test with 4.6 m of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 4.6 m in height, test systems in 4.6 m vertical sections as piping is installed.]

### Exfiltration Test:

#### Hydrostatic Head:

##### A minimum of [1.8] [ ]metre(s) above maximum estimated groundwater level in section being tested.

##### A maximum of [1.8] [ ] metre(s) above inside the top of highest section of pipe in test section, including service connections.

#### Length of Pipe Tested: Limit length such that pressure on invert of lower end of section does not exceed [9.1] [     ] m of water column.

### Infiltration Test:

#### Groundwater Level: At least [1.8] [ ]meter above inside top of highest section of pipe in test section, including service connections.

### Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if the pipe previously passed a pressure test.

### Defective Piping Sections: [Replace] [or] [test and seal individual joints], and retest as specified above.

## Pneumatic Test for Gravity Piping

### Equipment:

#### Calibrate gauges with standardized test gauge provided by the [Consultant] at the start of each testing day. The [Consultant]will witness calibration.

#### Install gauges, air piping manifolds, and valves at ground surface.

#### Provide pressure release device, such as rupture disc or pressure relief valve, to relieve pressure at 41.4 kPa or less.

#### Restrain plugs used to close sewer lines to prevent blow-off.

### Procedure:

#### The Contractor shall not allow any person to enter a maintenance hole where the pipe is under pressure. Follow the approved Safety Plan (refer to Section 01351 – Health and Safety requirements).

#### Slowly introduce air into the pipe section until internal air pressure reaches 27.6 kPa greater than the average back pressure of groundwater submerging pipe.

#### Allow a minimum of 2 minutes for air temperature to stabilize.

### Allowable Leakage: Test section of the pipe will be considered defective when the time (seconds) required for the pressure to decrease from a range of 24.1 kPa to 17.2 kPa above the average back pressure of groundwater surrounding the submerged pipe is less than that values contained in the following table*: [Consultant to validate Table 1 accuracy and amend as required]*

| TABLE 1\* | | | | | |
| --- | --- | --- | --- | --- | --- |
| A    Pipe Diameter (mm) | B  Time per metre up to Length in Col C (Seconds) | C  Test Length (m) | D    Test Time for any Length Between Col C & E (Min:Sec) | E  Length at which Time in Col F Applies (m) | F  Time per Meter for Total Length (Seconds) |
| 100 | 0.59 | 193.9 | 1:54 | 339.5 | 0.33 |
| 150 | 1.31 | 129.2 | 2:50 | 226.5 | 0.75 |
| 200 | 2.33 | 96.9 | 3:47 | 169.8 | 1.34 |
| 250 | 3.64 | 77.7 | 4:43 | 135.9 | 2.07 |
| 300 | 5.25 | 64.5 | 5:40 | 111.3 | 2.98 |
| 375 | 8.20 | 51.8 | 7:05 | 89.1 | 4.66 |
| 450 | 11.90 | 43.0 | 8:30 | 74.4 | 6.75 |
| 525 | 16.13 | 36.9 | 9:55 | 63.9 | 9.21 |
| 600 | 21.05 | 32.3 | 11:20 | 56.1 | 12.03 |
| EXAMPLE: 375 mm diameter pipe: For 50 m, T = 8.20 sec (Col B) x 50 m = 410 sec = 6:50 For 75 m, T = 7:05 (Col D) For 150 m, T = 4.66 sec (Col F) x 150 m = 699 sec = 11:39 | | | | | |
| \*Based on 0.015 L/s/m2 with a minimum significant loss of 0.94 L/s and a maximum loss of 1.65 L/s. | | | | | |

### Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if the pipe previously passed a pressure test.

### Defective Piping Sections: [A: Replace] [B: or] [C: test and seal individual joints], and re-test as specified.

## Field Quality Control

### Pipe leakage testing shall be performed and be approved prior to the start of any commissioning activities. Commissioning activities shall be performed in accordance with Section 01810 - Equipment Testing and Facility Commissioning.

### Test Report Documentation shall include, but not be limited to, the following:

#### Test date.

#### Description and identification of piping tested.

#### Test fluid.

#### Test pressure.

#### Remarks, including:

##### Leaks (type, location).

##### Repair/replacement performed to remedy excessive leakage.

#### Signatures of the Contractor and the [Consultant] to represent that the test has been satisfactorily completed.

**END OF SECTION**