

# **CHAPTER 600**

## **TESTING**

## **SECTION 601**

### **General**

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#### 601.01 Introduction

This Section provides the testing requirements common to all sanitary sewer facilities.

For testing requirements specific to sanitary sewers refer to Section 602.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to manholes refer to Section 604.

For testing requirements specific to lift stations refer to Section 605.

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#### 601.02 General Testing Requirements

All testing shall be performed under the observation of the RPR. It is the Contractor's responsibility to schedule the testing.

Test results obtained in the absence of the Division's RPR or Department will not be accepted.

The Contractor shall be responsible for providing all testing equipment at no cost to the City.

All pressure gages used shall be calibrated within one (1) year of use for any test. Calibration papers and test date information shall be made available at the request of the RPR, Division, or Department.

The City of Indianapolis will not assume any liability for the actions of the Owner, Contractor, or their agent(s), in the performance of the required tests.

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## SECTION 602 Gravity Sanitary Sewer Testing Requirements

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### 602.01 Introduction

This Section provides the testing requirements specific to gravity sanitary sewers.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to manholes refer to Section 604.

For testing requirements specific to lift stations refer to Section 605.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

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### 602.02 General Requirements

All sanitary sewers twenty-four (24) inches and less shall be air tested by means of a low pressure air test per Section 602.03. All sewers larger than twenty-four (24) inches shall be joint tested per Section 602.04.

All sanitary sewers constructed of flexible pipe (PVC and Centrifugally Cast Fiberglass Reinforced Polymer Mortar) shall be tested for deflection by means of a mandrel test per Section 602.06.

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### 602.03 Low Pressure Air Test

All sewers twenty-four (24) inches and less shall be tested by means of a low-pressure air test to detect damaged piping and/or improper jointing. Testing shall be done per ASTM F 1417 for flexible and semi-rigid pipe and ASTM C 924 for RCP. The use of the low pressure air test for flexible and semi-rigid pipe larger than twenty-four (24) inches will be evaluated on a case-by-case basis.

The Contractor is responsible for assuring the test is conducted in a safe manner and all applicable safety procedures are followed.

Do not enter, or allow anyone to enter, the manhole during testing.

The low pressure air test shall be as follows:

1. Waiting Period

The air test may be done immediately after final backfill is placed in the trench.

2. Equipment

At a minimum, the following shall be provided:

- a. Mechanical or pneumatic plugs;
  - b. Air control panel;
  - c. Shut-off valve, pressure regulative valve, pressure relief valve, and input pressure gauge. The pressure regulator or relief valve shall be set no higher than 9 psig (6 psig for RCP) to avoid over pressurization;
  - d. Continuous monitoring pressure gauge having a range of 0 to at least 10 psi. The gauge shall be no less than four (4) inches in diameter with minimum divisions of 0.10 psi and an accuracy of  $\pm 0.04$  psi;
  - e. To reduce the potential for sewer line over-pressurization, two (2) separate hoses shall be used to:
    - i. Connect the control panel to the sealed line for introducing low pressure air; and
    - ii. Constantly monitor air pressure buildup in the line.
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If pneumatic plugs are utilized, a separate hose shall be required to inflate the pneumatic plugs.

3. Testing Procedures

The Test Data Sheet per Appendix C shall be used when conducting the air test.

The procedures for the low pressure air test are as follows:

a. Plug Installation

After a segment of pipe has been backfilled to final grade, securely place and brace suitable test plugs in the ends of the sewer segment and in all lateral stubs included in the test.

All plugs shall be securely restrained and braced prior to and during the test.

b. Line Pressurization

Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig PLUS the necessary adjustment for groundwater (Maximum 2.0 psig adjustment for a 6.0 psig maximum total).

The air pressure adjustment for groundwater shall be determined by the following:

$$\text{Adjustment} = \text{Depth of Groundwater} \times 0.43$$

where:

Adjustment = Adjustment added to the starting pressure of the low-pressure air test, psig. **The maximum adjustment shall be 2.0 psig.**

Depth of Groundwater = As measured above the top of pipe, feet.

0.43 = Conversion factor

**Do not exceed 6.0 psig at any time during the low-pressure air test.**

The groundwater monitoring wells installed per Section 403.09 shall be used to determine the depth of groundwater. If more than one well was installed, take the average depth of the nearest downstream and nearest upstream monitoring locations. If the monitoring wells were not installed, the adjustment shall be 2.0 psig.

c. Pressure Stabilization

After a constant pressure of 4.0 psig (PLUS the necessary adjustment for groundwater) is reached, the air supply shall be throttled to maintain that internal pressure for at least two (2) minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

d. Timing Pressure Loss

When temperatures have been equalized and the pressure stabilized at 4.0 psig (PLUS the necessary adjustment for groundwater), the air hose from the control panel to the air supply shall be shut off or disconnected.

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The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (PLUS the necessary adjustment for groundwater). At this reading, or any convenient observed pressure reading between 3.5 psig and 4.0 psig (PLUS the necessary adjustment for groundwater), timing shall begin.

A timed pressure drop of either 1.0 psig or 0.5 psig shall be used. The RPR shall determine the appropriate pressure drop. The allowable time shall be predetermined using either Table 600.01 or 600.02, depending on which pressure drop is used.

When testing RCP sewers, a 1.0 psig pressure drop shall be used.

e. Time adjustment for laterals

No time adjustment for lateral lengths will be allowed.

f. Determination of Line Acceptance

If the time shown for the designated pipe size and length elapses before the pressure drops (1.0 or 0.5 psig), the section of pipe being tested shall have passed the test.

The test may be discontinued once the prescribed time has elapsed even though the pressure drop has not occurred.

g. Determination of Line Failure

If the pressure drops before the appropriate time has elapsed, the air loss rate shall be considered excessive and the section of pipe being tested shall have failed the test.

The Contractor shall be required to uncover, replace, or repair any section of sewer not passing the test. The method of repair shall be per approval of the Division and/or Department. Grouting is not an acceptable method of repair.

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602.04  
Joint Test

All sewers greater than twenty-four (24) inches shall be joint tested using air or water under low pressure. All joints shall be tested. Testing procedures shall be per ASTM C 1103 and as follows:

1. Waiting Period

The joint test may be done immediately after final backfill is placed.

2. Equipment

Equipment used shall be made specifically for joint testing of pipelines.

3. Testing Procedures

a. Joint Test Apparatus Installation

i. Clean the joint and interior joint surfaces.

ii. Move the joint test apparatus into the sewer line to the joint to be tested and position it over the joint. Make sure the end element sealing tubes straddle both sides of the joint and the hoses are attached. For the water test, the bleed-off petcock must be located at top dead center.

iii. Inflate end element sealing tubes with air in accordance with equipment and manufacturer's instructions.

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b. Joint Air Test

- i. Pressurize the void volume with air to 3.5 psi PLUS the necessary adjustment for groundwater above the top of pipe (maximum 2.0 psi adjustment for a 5.5 psi maximum total). Allow the air pressure and temperature to stabilize before shutting off the air supply. Start the timing of the test.

The air pressure adjustment shall be per Section 602.03.3.b.

- ii. Measure the pressure drop for five (5) seconds.
- iii. After the joint test is completed, exhaust void volume, then exhaust end element tubes prior to removal of the testing apparatus.

c. Joint Water Test

- i. Introduce water into the void volume until water flows evenly from open petcock. Close the petcock and pressurize with water to 3.5 psi PLUS the necessary adjustment for groundwater above the top of pipe (maximum 2.0 psi adjustment for a 5.5 psi maximum total). Shut off the water supply and start test timing.

- ii. Measure the pressure drop for five (5) seconds.

- iii. After the joint test is completed, exhaust end element tubes which will automatically release the water from the void volume, prior to removal of the testing apparatus.

d. Determination of Line Acceptance

If the pressure holds or drops less than one (1) psi for the five (5) second test time, the joint shall have passed the test.

e. Determination of Line Failure

If the pressure drops one (1) psi or more during the five (5) second test time, the joint shall have failed the test.

If the joint fails, the Contractor shall repair and retest as necessary. The method of repair shall be per approval of the Division and/or Department. Grouting is not an acceptable method of repair.

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602.05  
Water Infiltration  
Test

All gravity sanitary sewers shall be watertight and free from leakage.

The rate of infiltration into the sanitary sewer system between any two adjacent manholes or the entire system shall not be in excess of 100 gallons per inch of pipe diameter per mile per day (100 gpd/in-dia/mi).

The Contractor may be required to conduct a weir test to determine if the 100 gal/in/mi/day maximum allowable infiltration rate is being exceeded.

The weir test will be required if water is observed in the sewer at any time during the acceptance process. The weir test will be at the sole discretion of the RPR, Division, or Department.

The Contractor shall be required to repair all visible leaks, even if the allowable infiltration requirements are met. The method of repair shall be per the approval of the Division and/or Department.

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Grouting of the joint or crack to repair the leakage shall not be permitted. If the defective portion of the sanitary sewer cannot be located, the Contractor shall remove and reconstruct as much of the work as necessary to obtain a system that passes infiltration requirements.

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602.06  
Mandrel Deflection  
Test for Flexible  
Pipe

All sanitary sewers using flexible pipe shall be tested for deflection by means of a go/no-go mandrel gage or other methods as approved by the Department.

The mandrel deflection test shall be as follows:

1. Waiting Period

The mandrel deflection test shall be done no sooner than thirty (30) days after final backfill has been placed.

2. Equipment

Mandrels shall be constructed with nine (9) or ten (10) arms. Mandrels with fewer than nine (9) arms are not allowed.

The Length (L) shall be measured between points of contact on the mandrel arm.

The Diameter (D) mandrel dimension shall carry a tolerance of  $\pm 0.01$  inches.

3. Allowable Deflection

The allowable deflection shall be based on the pipe type as follows:

a. PVC Pipe

The allowable deflection for PVC pipe shall be 5% of the base inside diameter as determined by ASTM D 3034 and F 679. The dimensions are as follows:

| <b>DIMENSIONS FOR MANDREL</b> |                               |                         |  |
|-------------------------------|-------------------------------|-------------------------|--|
| Nominal Pipe Diameter, inches | Length (L) of Mandrel, inches | Base ID of Pipe, inches | Diameter (D) <sup>1</sup> for Deflection of 5%, inches |
| 8                             | 8.0                           | 7.665                   | 7.28   |
| 10                            | 10.0                          | 9.563                   | 9.08   |
| 12                            | 10.0                          | 11.361                  | 10.79  |
| 15                            | 12.0                          | 13.898                  | 13.20  |

<sup>1</sup> – The diameter is based on SDR 35 pipe thickness, if thicker pipe is used, the diameter may be adjusted accordingly.

b. Closed Profile PVC

The allowable deflection for Closed Profile PVC shall be 5% based on the inside diameter as determined on a case-by-case evaluation of the pipe design.

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c. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe

i. Polyester Resin

The allowable deflection for Centrifugally Cast Fiberglass Reinforced Polymer Mortar pipe made with polyester resin shall be 4% based on the inside diameter as determined on a case-by-case evaluation of the pipe design.

ii. Vinyl Ester Resin

The allowable deflection for Centrifugally Cast Fiberglass Reinforced Polymer Mortar pipe made with vinyl ester resin shall be 3% based on the inside diameter as determined on a case-by-case evaluation of the pipe design.

The Contractor shall provide proving rings to check the mandrel. The proving rings shall be clearly labeled with the dimensions and ASTM Standard.

4. Testing Procedure

a. The mandrel shall be hand pulled through all sections of the sewer lines.

b. Determination of Line Acceptance

If the mandrel can be hand pulled through the entire length of the section tested, the section shall have passed the test.

c. Determination of Line Failure

If the mandrel cannot be hand pulled through the entire length of the section tested, the section shall have failed the test.

The Contractor shall be required to uncover, replace, or repair any section of sewer not passing the mandrel test.

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602.07  
Air Test or  
Mandrel  
Test Failures

To determine the location of any failure, a visual inspection by means of closed circuit televising (CCTV) is recommended when the air or mandrel tests fail.

The pipe shall be thoroughly cleaned before televising.

If a CCTV inspection was conducted, then a digital copy of the inspection shall be submitted to the Division for review.

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## SECTION 603

### Force Main Testing Requirements

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#### 603.01 Introduction

This Section provides the testing requirements for force mains and low pressure systems.

For testing requirements specific to sanitary sewers, refer to Section 602.

For testing requirements specific to manholes refer to Section 604.

For testing requirements specific to lift stations refer to Section 605.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

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#### 603.02 General Requirements

All force mains for lift stations and common force mains in low pressure systems shall be tested for leakage by a Hydrostatic Leak Test per Section 603.03.

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#### 603.03 Hydrostatic Leak Test

The hydrostatic leak test shall be done in accordance with AWWA standards based on force main material, in accordance with ASTM E 1003, and as follows:

1. Waiting Period

The hydrostatic test may be done immediately after final backfill is placed and the air and/or vacuum release valves are installed.

2. Equipment

At a minimum, the following shall be provided:

- a. Hydrostatic Test Pump (jockey pump).
- b. Continuous monitoring pressure gage having a range of 0 – 150 psi graduated in 1 psi increments. The gauge shall be no less than four (4) inches in diameter.
- c. Pipe plugs and/or caps. The plugs/caps shall be equipped with a minimum of two (2) openings for filling/draining the force main and for bleeding air from the line.
- d. Calibrated/graduated container to measure the quantity of water required to be added during the hydrostatic test to maintain the test pressure.

3. Testing Procedures

The procedures for the hydrostatic test are as follows:

a. Plug/cap installation

After the force main has been backfilled to final grade, securely plug and/or bulkhead the ends being tested. Thrust blocking restraints shall be installed at each bulkhead in accordance with the bulkhead manufacturer's requirements.

b. Air and/or Vacuum Release Valves

All air and/or vacuum release valves shall be installed and in normal (open) in-service position during the test.

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c. Line Pressurization

- i. The force main shall be slowly pressurized with water to 1.5 times the working pressure, or 100 psi, whichever is greater.
- ii. Trapped air shall be expelled through high point bleed off valves as the force main is being filled.
- iii. When the pressure has been reached, the test pump shall be shut off.
- iv. After the force main has been pressurized, measure the pressure drop for two (2) hours.

d. Determination of Force Main Acceptance

If no pressure drop occurs within the two (2) hour test time, the force main shall have passed the test.

e. Determination of Force Main Failure

If a pressure drop occurs within the two (2) hour test time, the force main shall have failed the test.

Contractor shall repair any defects and retest, or retest per the Alternate Testing Procedure.

4. Alternate Testing Procedure

a. Plug/Cap Installation

Same as the above Testing Procedures

b. Line Pressurization

The force main shall be slowly pressurized with water to a test pressure 1.5 times the working pressure or 100 psi, whichever is greater. Water shall be added to maintain the test pressure for two (2) hours.

c. Determination of Force Main Acceptance

The amount of water added during the line pressurization shall be measured. The allowable leakage, in gallons per hour, shall be calculated as follows:

- i. For PVC Pipe

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

- ii. For Ductile Iron Pipe

$$L = (SD(P)^{1/2}) / 133,200$$

where:

$L$  = allowable leakage, gph

$N$  = number of joints in the pipeline tested

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$S$  = length of pipe tested, feet

$D$  = nominal diameter of the pipe, in.

$P$  = average test pressure (psi)

If the amount of water added is less than the allowable leakage, the force main shall have passed the test.

d. Determination of Force Main Failure

If the amount of water added is greater than the allowable leakage, the force main shall have failed the test.

The Contractor shall be required to uncover, replace, or repair the force main and/or air release valve and retest.

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## SECTION 604 Manhole Testing Requirements

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### 604.01 Introduction

This Section provides the testing requirements for manholes.

For testing requirements specific to sanitary sewers refer to Section 602.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to lift stations refer to Section 605.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

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### 604.02 General Requirements

All manholes shall be tested for infiltration by means of a negative air (vacuum) pressure test per Section 604.04.

All internal chimney seals shall be tested per Section 604.05.

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### 604.03 Leakage

All manholes shall be watertight and free from leakage.

Each manhole shall be visually inspected for leakage by the Division's RPR after assembly and backfilling.

If the manhole shows signs of leakage, the manhole shall be repaired to the satisfaction of the Division and reinspected.

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### 604.04 Negative Air (Vacuum) Test

All manholes shall be tested for infiltration by means of a Negative Air (Vacuum) Pressure Test. Testing shall be done per ASTM C 1244.

**All joints between the top of casting to the bottom of the manhole base shall be included in the test.**

The vacuum test shall be as follows:

#### 1. Waiting Period

If possible, each manhole shall be tested immediately after assembly and prior to backfilling. If the test is done after backfilling, the Contractor shall be responsible for re-excavation to locate and correct any leaks that have been identified.

The vacuum test shall be done BEFORE the chimney seal is installed and tested.

#### 2. Equipment

Equipment used shall be made specifically for vacuum testing of manholes.

#### 3. Testing Procedures

##### a. Plug Installation

All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

##### b. Test Head Installation

The test head shall be placed at the top of the manhole casting in accordance with the manufacturer's recommendations.

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c. Air Evacuation

A vacuum of ten (10) inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off.

d. Timing Pressure Rise

The time for the vacuum reading to drop from ten (10) inches to nine (9) inches of mercury shall be measured. The allowable time shall be determined by using the following:

| Minimum Test Times  |                      |    |     |
|---------------------|----------------------|----|-----|
| Manhole Depth, feet | Manhole Diameter, in |    |     |
|                     | 48                   | 60 | 72  |
|                     | Time, seconds        |    |     |
| 8                   | 20                   | 26 | 33  |
| 10                  | 25                   | 33 | 41  |
| 12                  | 30                   | 39 | 49  |
| 14                  | 35                   | 46 | 57  |
| 16                  | 40                   | 52 | 67  |
| 18                  | 45                   | 59 | 73  |
| 20                  | 50                   | 65 | 81  |
| 22                  | 55                   | 72 | 89  |
| 24                  | 59                   | 78 | 97  |
| 26                  | 64                   | 85 | 105 |
| 28                  | 69                   | 91 | 113 |
| 30                  | 74                   | 98 | 121 |

e. Determination of Manhole Acceptance

If the time shown for the designated manhole depth and diameter elapses before the vacuum reading drops one (1) inch, the manhole shall have passed the test.

f. Determination of Manhole Failure

If the vacuum reading drops more than one (1) inch before the appropriate time has elapsed, the manhole shall have failed the test.

The Contractor shall be required to uncover, replace, or repair any or all sections of the manhole and retest.

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604.05  
Chimney Seal  
Leakage Test

All internal chimney seals shall be tested using a leakage test.

The leakage test shall be as follows:

1. Waiting Period

The leakage test shall be done AFTER the manhole has passed the vacuum test.

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## 2. Testing Procedures

- a. Install the chimney seal and only the bottom expansion band per manufacturer's recommendation. Fully tighten the bottom band. Do not install the top expansion band.
- b. Pulling the top of the seal away from the manhole frame, pour one (1) gallon of water behind the seal.
- c. Observe the bottom seal for a minimum of one (1) minute for leakage.
- d. Drain the water by folding the top of the chimney seal down.
- e. If the chimney seal passes the test, install the top expansion band per manufacturer's recommendation.

## 3. Determination of Chimney Seal Acceptance

If the bottom expansion band holds water without leaking, the chimney seal will have passed the test.

## 4. Determination of Chimney Seal Failure

If the bottom expansion band has any leakage during the test time, the chimney seal will have failed the test.

The Contractor shall be required to remove, replace, or reposition the bottom expansion band and retest.

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## SECTION 605 Lift Station Testing

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### 605.01 Introduction

This Section provides the testing requirements for lift stations.

For testing requirements specific to sanitary sewers refer to Section 602.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to manholes refer to Section 604.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

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### 605.02 General Requirements

The force main and all gravity sanitary sewers constructed as part of the project shall have passed all required tests prior to the startup and final acceptance of the lift station.

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### 605.03 Wet Well Leakage Testing

All wet wells shall be watertight and free from leakage.

The wet well shall be visually inspected for leakage by the Division's RPR after assembly and backfilling.

All dewatering activities shall be ceased a minimum of eight (8) hours prior to the leak testing.

If the wet well shows signs of leakage, it shall be repaired to the satisfaction of the Division and reinspected.

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### 605.04 Lift Station Testing

All equipment testing shall be observed by the Department and the RPR during the lift station's final inspection.

Partial testing will not be accepted. The testing must be done on the complete lift station.

It is not the RPR's, Division's, or Department's responsibility to engage in ANY activity or supply ANY equipment to test and/or accept the lift station.

The Contractor shall provide the clean water to run the pumps and perform all tests.

The startup and final inspection shall be as follows:

#### 1. Waiting Period

The waiting period shall be after BOTH of the following:

- a. AFTER the force main, gravity sewers and manholes constructed as part of the project have passed all required tests contained in Sections 602, 603, and/or 604.
- b. After ALL equipment has been installed, been determined to be in working order by the Contractor and manufacturer, and been previously tested by the manufacturer.

#### 2. Equipment

The Contractor or manufacturer shall provide all necessary equipment to safely complete all the tasks necessary to test and accept the lift station.

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### 3. Testing Procedures

A lift station checklist provided by the Department shall be completed during the start-up and final inspection.

The test shall verify all equipment performs in accordance with the design and the requirements of this Manual. Procedures for each component shall be determined by the Department at the time of startup. At a minimum, the following shall be tested:

- a. Pumping rate for all pumps in gpm;
- b. Communications equipment;
- c. Programmable Logic Controller;
- d. All electronic equipment;
- e. All mechanical equipment;
- f. All instrumentation and control equipment;
- g. All programming;
- h. Incoming power;
- i. The overall operating condition of the lift station; and
- j. Any other test the Department deems necessary.

### 4. Calibration

All measuring equipment supplied for the lift station shall be calibrated prior to acceptance. Calibration test results shall be made available upon request.

The measuring equipment shall include at a minimum the following:

- a. Level Transducers;
- b. Flow Meters;
- c. Gauges; and
- d. Other equipment as deemed necessary by the Department.

### 5. Determination of Lift Station Acceptance

If the station performs to the satisfaction of the Department, as designed, and per the requirements of this Manual, the lift station shall have passed the test.

### 6. Determination of Lift Station Failure

If the station does not perform to the satisfaction of the Department, as designed, and per the requirements of this Manual, the lift station shall have failed the test.

The Contractor shall be required to correct all deficiencies and retest.

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**TABLE 600.02**

**MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE FOR FLEXIBLE AND SEMI-RIGID PIPE**

| 1<br>Pipe Diameter (in) | 2<br>Minimum Time (min:sec) | 3<br>Length for Minimum time (ft) | 4<br>Time for Longer Length | Specification Time for Length (L) Shown (min:sec) |        |        |        |        |        |        |        |        |        |        |        |        |        |
|-------------------------|-----------------------------|-----------------------------------|-----------------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                         |                             |                                   |                             | 100 ft  | 150 ft | 200 ft | 250 ft | 300 ft | 350 ft | 400 ft | 450 ft | 500 ft |        |        |        |        |        |
| 4                       | 1:53                        | 597                               | 0.190 L                     | 1:53  | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   | 1:53   |
| 6                       | 2:50                        | 398                               | 0.427 L                     | 2:50  | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   | 2:50   |
| 8                       | 3:47                        | 298                               | 0.760 L                     | 3:47  | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   | 3:47   |
| 10                      | 4:43                        | 239                               | 1.187 L                     | 4:43  | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   | 4:43   |
| 12                      | 5:40                        | 199                               | 1.709 L                     | 5:40  | 5:40   | 5:42   | 7:08   | 8:33   | 9:58   | 11:24  | 13:21  | 15:35  | 17:48  | 20:02  | 22:16  | 24:30  | 26:44  |
| 15                      | 7:05                        | 159                               | 2.671 L                     | 7:05  | 7:05   | 8:54   | 11:08  | 13:21  | 15:35  | 17:48  | 20:02  | 22:16  | 24:30  | 26:44  | 28:58  | 31:12  | 33:26  |
| 18                      | 8:30                        | 133                               | 3.846 L                     | 8:30  | 9:37   | 12:49  | 16:01  | 19:14  | 22:26  | 25:38  | 28:51  | 32:03  | 35:16  | 38:28  | 41:41  | 44:54  | 48:07  |
| 21                      | 9:55                        | 114                               | 5.235 L                     | 9:55  | 13:05  | 17:27  | 21:49  | 26:11  | 30:32  | 34:54  | 39:16  | 43:38  | 47:59  | 52:21  | 56:43  | 61:05  | 65:27  |
| 24                      | 11:20                       | 99                                | 6.837 L                     | 11:24   | 17:57  | 22:48  | 28:30  | 34:11  | 39:53  | 45:35  | 51:17  | 56:59  | 62:41  | 68:23  | 74:05  | 79:47  | 85:29  |
| 27 <sup>1</sup>         | 12:45                       | 88                                | 8.653 L                     | 14:25   | 21:38  | 28:51  | 36:04  | 43:16  | 50:30  | 57:42  | 64:54  | 72:06  | 79:18  | 86:30  | 93:42  | 100:54 | 108:06 |
| 30 <sup>1</sup>         | 14:10                       | 80                                | 10.683 L                    | 17:48   | 26:43  | 35:37  | 44:31  | 53:25  | 62:19  | 71:13  | 80:07  | 89:01  | 97:55  | 106:49 | 115:43 | 124:37 | 133:31 |
| 33 <sup>1</sup>         | 15:35                       | 72                                | 12.926 L                    | 21:33   | 32:19  | 43:56  | 53:52  | 64:38  | 75:24  | 86:10  | 96:57  | 107:43 | 118:29 | 129:15 | 140:01 | 150:47 | 161:33 |
| 36 <sup>1</sup>         | 17:00                       | 66                                | 15.384 L                    | 25:39   | 38:28  | 51:17  | 64:06  | 76:55  | 89:44  | 102:34 | 115:23 | 128:12 | 141:01 | 153:50 | 166:39 | 179:28 | 192:17 |

<sup>1</sup> - Per Section 602.03, the low pressure air test for these pipe diameters can only be conducted with prior approval of the Department.

## EXAMPLE LOW PRESSURE AIR TESTS

### A. GENERAL

The purpose of this Section is to illustrate the proper application of this recommended practice with regard to appropriate test time selection. The examples that follow include a variety of conditions which may be encountered in the field.

#### 1. EXAMPLE A

A manhole to manhole reach of nominal 12-inch pipe is 350 feet long. No lateral connections exist in the reach. What is the required test time for a 0.5 psig pressure drop?

Solution: The required test time can be read directly from Table 600.02. For 350 feet of 12-inch pipe, the required test time is 9:58 (9 minutes and 58 seconds).

#### 2. EXAMPLE B

What should the required test time be for a 1.0 psig pressure drop in 327 feet of nominal 8-inch diameter pipe between two manholes?

Solution: The exact test time is easily calculated by using Table 600.01. Table 600.01 is used because a 1.0 psig pressure drop is specified. Since 327 feet exceeds the minimum test time for an 8-inch pipeline, the fourth column in Table 600.01 shall be used to quickly calculate the required test time as follows:

$$T = 1.520 L$$
$$T = 1.520 \times 327 \text{ ft} = 497 \text{ seconds}$$

Therefore, the required test time for a 1.0 psig pressure drop is 497 seconds, or 8 minutes and 17 seconds (8:17).

#### 3. EXAMPLE C

A manhole-to-manhole reach of nominal 24-inch pipe is 82-feet long. What is the required test time for a 0.5 psig pressure drop?

Solution: Table 600.02 must be used because a 0.5 psig pressure drop is specified. Since 82 feet is less than the 99 foot length associated with the minimum test for a 24-inch pipeline, the minimum test time shall apply. Thus, the required test time for a 0.5 psig pressure drop must be 11 minutes and 20 seconds (11:20).

#### 4. EXAMPLE D

A 412 foot section of nominal 15-inch sewer pipe has been readied for air testing. A total of 375 feet of nominal 6-inch lateral piping and 148 feet of nominal 4-inch lateral piping branch off of the 15-inch sewer line. All laterals have been capped and/or plugged and will be tested together with the 15-inch main line. The specified pressure drop which will be timed is 0.5 psig. What is the appropriate test time for this pipe network?

Solution: All lateral sewer sizes and lengths may be disregarded since their influence is generally not significant enough to warrant computation. Table 600.02 must be used for a 0.5 psig pressure drop. The fourth column in the Table provides the appropriate formula for calculating the required test time because 412 feet is longer than the third column value of 159 feet.

$$T = 2.671 L$$
$$T = 2.671 \times 412 = 1,100 \text{ seconds.}$$

The required test time is 1,100 seconds or 18 minutes, 20 seconds (18:20)