ITEM NO. 849
SANITARY SEWER PIPE AIR AND DEFLECTION TESTING

849.1 DESCRIPTION: This item shall consist of air and deflection tests in accordance with this specification and as directed by the Engineer.

849.2 SUBMITTALS: Contractor shall submit manufacturer’s product data instructions, recommendations, shop drawings, and certifications.

849.3 MATERIALS: The materials installed for air and deflection tests shall conform to the appropriate specifications contained within the latest revision of SAWS’ Material Specifications.

849.4 TESTING OF INSTALLED PIPE: The Contractor shall perform a low-pressure air test, or an infiltration/exfiltration test, and a mandrel test before the installed work shall be considered accepted. If a gravity collection main is composed of flexible pipe, a deflection test will also be required. Flexible pipe is defined as pipe that will deflect at least 2% without structural distress. Contractor shall insure that all testing is performed in the presence of the Inspector, with copies of all written test results made available to the Inspector. Tests shall conform to the following requirements:

1. Low-Pressure Air Test: The procedure for the low-pressure air test shall conform to the procedures described in ASTM C828, ASTM C924, and ASTM F1417 (or other appropriate procedures), except for testing times. The test times shall be as outlined in this section. For sections of pipe less than 36-inch average inside diameter, the following procedure shall apply. The pipe shall be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure is stabilized, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed from the following equation:

\[
T = \frac{0.085 \times D \times K}{Q}
\]

T = Time for pressure to drop 1.0 pound per square inch gauge in seconds;

K = 0.000419xDxL, but not less than 1.0;

D = Average inside pipe diameter, in inches;
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\[ L = \text{Length of line of same pipe size being tested, in feet;} \]

\[ Q = \text{Rate of loss, 0.0015 cubic feet per minute per square foot internal surface shall be used since a K value of less than 1.0 shall not be used.} \]

The minimum testing times for each pipe diameter is as follows:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Minimum Time</th>
<th>Length for Minimum Time</th>
<th>Time for Longer Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td>Seconds</td>
<td>Feet</td>
<td>Seconds/Ft</td>
</tr>
<tr>
<td>6</td>
<td>340</td>
<td>398</td>
<td>0.855</td>
</tr>
<tr>
<td>8</td>
<td>454</td>
<td>298</td>
<td>1.520</td>
</tr>
<tr>
<td>10</td>
<td>567</td>
<td>239</td>
<td>2.374</td>
</tr>
<tr>
<td>12</td>
<td>680</td>
<td>199</td>
<td>3.419</td>
</tr>
<tr>
<td>15</td>
<td>850</td>
<td>159</td>
<td>5.342</td>
</tr>
<tr>
<td>18</td>
<td>1,020</td>
<td>133</td>
<td>7.693</td>
</tr>
<tr>
<td>21</td>
<td>1,190</td>
<td>114</td>
<td>10.471</td>
</tr>
<tr>
<td>24</td>
<td>1,360</td>
<td>100</td>
<td>13.676</td>
</tr>
<tr>
<td>27</td>
<td>1,530</td>
<td>88</td>
<td>17.309</td>
</tr>
<tr>
<td>30</td>
<td>1,700</td>
<td>80</td>
<td>21.369</td>
</tr>
<tr>
<td>33</td>
<td>1,870</td>
<td>72</td>
<td>25.856</td>
</tr>
</tbody>
</table>

* Note: Test time starts after the required 60 seconds of stabilization time has transpired.

The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the testing period, then the test shall continue for the entire test duration as outlined above or until failure.

Mains with a 27 inch average inside diameter and larger must be air tested at each joint. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing. The pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge
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2. Infiltration/Exfiltration Test: The total exfiltration, as determined by a hydrostatic head test, must not exceed 50 gallons per inch of diameter per mile of main per 24 hours, at a minimum test head of 2 feet above the crown of the main at an upstream manhole. The Contractor shall use an infiltration test in lieu of an exfiltration test when mains are installed below the ground water level. In such cases, the total exfiltration, as determined by a hydrostatic head test, must not exceed 50 gallons per inch diameter per mile of main 24 hours at a minimum test head of 2 feet above the crown of the main at an upstream manhole, or at least 2 feet above the existing groundwater level, whichever is greater. For construction work occurring within a 25-year floodplain, the infiltration or exfiltration must not exceed 10 gallons per inch diameter per mile of main per 24 hours at the same minimum test head as stated in the previous sentence. If the quantity of infiltration or exfiltration exceeds the maximum quantity specified, the Contractor shall propose to the Engineer, and receive approval therefrom, all necessary remedial action, solely at the Contractor’s own cost, in order to reduce the infiltration or exfiltration to an amount within the limits specified herein.

3. Deflection Testing: As stated in the 30 TAC § 217, deflection test shall be performed on all flexible pipe installed.

   a. For mains with inside diameters less than 27 inches, a rigid mandrel shall be used to measure deflection.

   b. For main with an inside diameter 27 inches and greater, a method approved by the Engineer shall be used to test for vertical deflections.

The deflection test must be accurate to within ± 0.2% deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of five percent. If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the failed area’s final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices. The Engineer should recognize that this is a maximum deflection criterion for all pipes and a deflection test less than
5 % may be more appropriate for specific types and sizes of pipe. Upon completion of construction, the Engineer or other Texas Registered Professional Engineer appointed by the owner shall certify to the Inspector, that the entire installation has passed the deflection test. This certification may be made in conjunction with the notice of completion required in 30 TAC § 217.14. (1) of this title (relating to General Provisions). This certification shall be provided for the Owner to consider the requirements of the approval have been met.

a. Mandrel Sizing. The rigid mandrel shall have an outside diameter (O.D.) not less than 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. All dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

b. Mandrel Design: The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

c. Method Options: Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test.

849.5 MEASUREMENT: Air/Infiltration/Exfiltration and Deflection Testing will not be measured for payment.

849.6 PAYMENT: No direct payment shall be made for Air/Infiltration/Exfiltration and Deflection Testing, and all costs in connection therewith shall be included in the applicable contract price for the item to which the work pertains.

- End of Specification -

849-4 April 2014